Part 7

Summary

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PART 7, SUMMARY

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ABBREVIATIONS AND ACRONYMS

BHSS	Bunker Hill Superfund site
BLM	Bureau of Land Management
CdA	Coeur d'Alene
CDR	Coeur d'Alene River
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic foot per second
CIA	Central Impoundment Area
CLP	Contract Laboratory Program
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
Eco RA	Ecological Risk Assessment
EPA	U.S. Environmental Protection Agency
EV	expected value
FS	feasibility study
HHRA	human health risk assessment
I-90	Interstate 90
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
ITD	Idaho Transportation Department
km	kilometer
MCL	maximum contaminant level
µg/L	microgram per liter
µm	micrometer
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
North Fork	North Fork Coeur d'Alene River
NPL	National Priorities List
PbS	lead sulfide
RI	remedial investigation
ROD	Record of Decision
SFCDR	South Fork Coeur d'Alene River
South Fork	South Fork Coeur d'Alene River
SVNRT	Silver Valley Natural Resource Trustees
TMDL	total maximum daily load
U. of I.	University of Idaho

ABBREVIATIONS AND ACRONYMS (Continued)

USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WWR	Whole-Water Recoverable
ZnS	zinc sulfide

1.0 INTRODUCTION

The Coeur d'Alene Mining District is located within the Coeur d'Alene River basin in the eastern portion of the panhandle of northern Idaho (Figure 1-1). Mining in the district began more than 100 years ago. The district has been one of the leading lead-, zinc- and silver-producing areas in the world, with production of approximately 1.2 billion ounces of silver, 8 million tons of lead, and 3.2 million tons of zinc (Long 1998). Mining, milling, and smelting practices used in the district have resulted in substantial portions of the basin being contaminated by hazardous substances. The contamination resulted from the discharge or erosion of mill tailings and other mine-generated waste into the Coeur d'Alene River system and its tributaries (Figure 1-2).

The quantities of tailings discharged to the Coeur d'Alene River constitute a substantial amount of material. Estimates of the total amount of tailings discharged to the South Fork Coeur d'Alene River and its tributaries range from 54.5 to more than 70 million tons, depending on the source (Long 1998; Mine Systems Design, Inc., as cited in Shoshone Natural Resources Coalition 2000; MFG 1992). A 1998 estimate of 61.9 million tons developed by the U.S. Geological Survey (Long 1998) is believed to be the most accurate and falls near the midpoint of the range of estimates. Assuming that 1 cubic foot of tailings weighs approximately 125 pounds, if all the tailings discharged to the river were piled on a football field (approximately 100 yards by 50 yards), the pile would reach more than 4 miles high. Recognizing that the mining waste discharged to the river has been commingled with clean sediment, which then itself becomes contaminated, the total amount of contaminated material in the Basin is significantly greater than 61.9 million tons. These mill tailings and other mine-generated waste contained metals, such as cadmium, lead and zinc. Exposures to high concentrations of such metals have been associated with adverse impacts to human health and the environment.

In 1998, the U.S. Environmental Protection Agency (EPA) initiated a remedial investigation/ feasibility study (RI/FS) of mining-related contamination in the Coeur d'Alene Basin. This report presents the results of that remedial investigation. The study excludes an area known as the Bunker Hill Superfund site, which was previously investigated by EPA, but evaluates broad impacts on the river through the BHSS. The BHSS remedy explicitly excluded metals in the Coeur d'Alene River, although it was expected that remedial actions conducted at the site would improve water quality in the River. The basin, as evaluated in the remedial investigation, includes the Coeur d'Alene River and associated tributaries (including portions that run through the BHSS), Coeur d'Alene Lake, and the Spokane River downstream to the Washington State

Highway 25 bridge at Fort Spokane on the Spokane Arm of Lake Roosevelt. Collectively, this area is referred to as the Coeur d'Alene Basin.

1.1 PROJECT SCOPE AND REPORT ORGANIZATION

The Coeur d'Alene Basin remedial investigation follows an earlier RI/FS conducted in the basin. The earlier RI/FS focused on a 21-square mile area known as the Bunker Hill Superfund site. The BHSS RI/FS was completed and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Records of Decision (RODs) written in 1991 and 1992. Remedial actions under the two BHSS RODs are currently being implemented, largely addressing areas impacted by smelter operations. Actions under the BHSS RODs are expected to reduce the release of metals into the South Fork as it flows through the BHSS.

After issuance of the first two BHSS RODs, information from a variety of sources indicated broader impacts from mining contamination were present in the basin. This led to concern over risks to human health within residential communities and recreational areas and risks to ecological receptors such as fish and waterfowl outside the BHSS. To evaluate these impacts and risks in a comprehensive manner, EPA initiated the Coeur d'Alene Basin RI/FS in early 1998. EPA contracted with URS Greiner, Inc., and CH2M HILL to conduct the RI/FS, in partnership with the Coeur d'Alene Tribe, State of Idaho, State of Washington, and other federal, state, tribal and local agencies.

The geographic area evaluated in the Coeur d'Alene Basin RI/FS is included in the Bunker Hill Mining and Metallurgical complex facility that was added to the National Priorities List (NPL) in 1983. In September 1998, a federal district court judge ruled that this NPL facility was limited to the 21-square-mile area known as the Bunker Hill Superfund site *(U.S. v. ASARCO Inc.*, 28 F.Supp.2d 1170). However, this ruling was vacated on appeal in the Ninth Circuit Court of Appeals, leaving EPA's view that the Coeur d'Alene Basin is included in the Bunker Hill Mining and metallurgical complex facility. Inclusion on the NPL is not a precondition for the conduct of an RI/FS, pursuant to Section 104(b)(1) of CERCLA, 42 U.S.C. 1 9604(b)(1). See also NCP 40 CFR Part 300.425(b)(1).

To identify potential risks to human health and ecological receptors, the RI report summarizes data and analyses on the nature and extent of mining contamination in the basin. Data have been collected and analyses conducted through the RI/FS CERCLA process, 42 U.S.C. 9601 et seq., and the implementing regulations in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. The information presented in this RI report is used in the human health risk assessment (HHRA), ecological risk assessment (EcoRA), and feasibility study (FS).

To ensure opportunities for stakeholder involvement, EPA has accomplished the following:

- Prepared a Community Involvement Plan (USEPA 1999)
- Established an Administrative Record file and local information repositories
- Conducted or participated in dozens of public meetings and interviews in local communities
- Prepared and distributed fact sheets, established a web page, and circulated for public review draft documents, such as numerous field sampling plans and the technical work plan for the Bunker Hill Basin-Wide RI/FS (USEPA 1998)

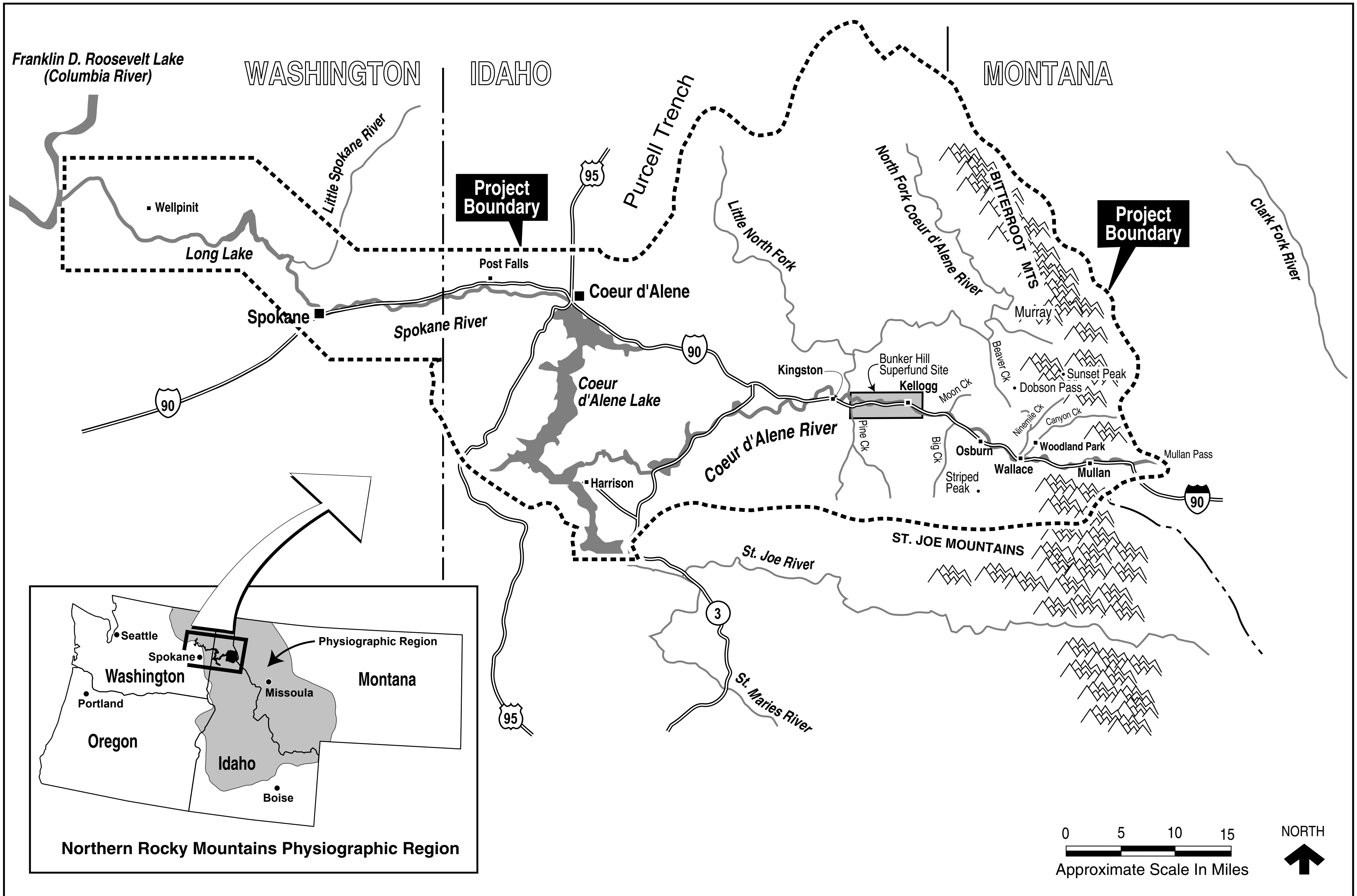
The content and organization of this report are based on EPA's *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (USEPA 1988).

The remedial investigation report is divided into seven parts:

- Part 1—Setting and Methodology
- Part 2—Remedial investigation results for Conceptual Site Model (CSM) Unit 1, Upper Watersheds
- Part 3—Remedial investigation results for CSM Unit 2, Midgradient Watersheds
- Part 4—Remedial investigation results for CSM Unit 3, Lower Coeur d'Alene River
- Part 5—Remedial investigation results for CSM Unit 4, Coeur d'Alene Lake
- Part 6—Remedial investigation results for CSM Unit 5, Spokane River
- Part 7 (**this part**)—Summary of the remedial investigation, which includes a summary of the regional physical setting (geology, geochemistry, hydrogeology,

hydrology, ecology, and demographics) and basinwide study results for soil/sediment, groundwater, and surface water

Risk evaluations and potential remedial actions associated with source and depositional areas are described under separate cover in the human health risk assessment, the ecological risk assessment, and the feasibility study.



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Coeur d'Alene Basin RI/FS
RI REPORT

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Figure 1-1
Project Location Map

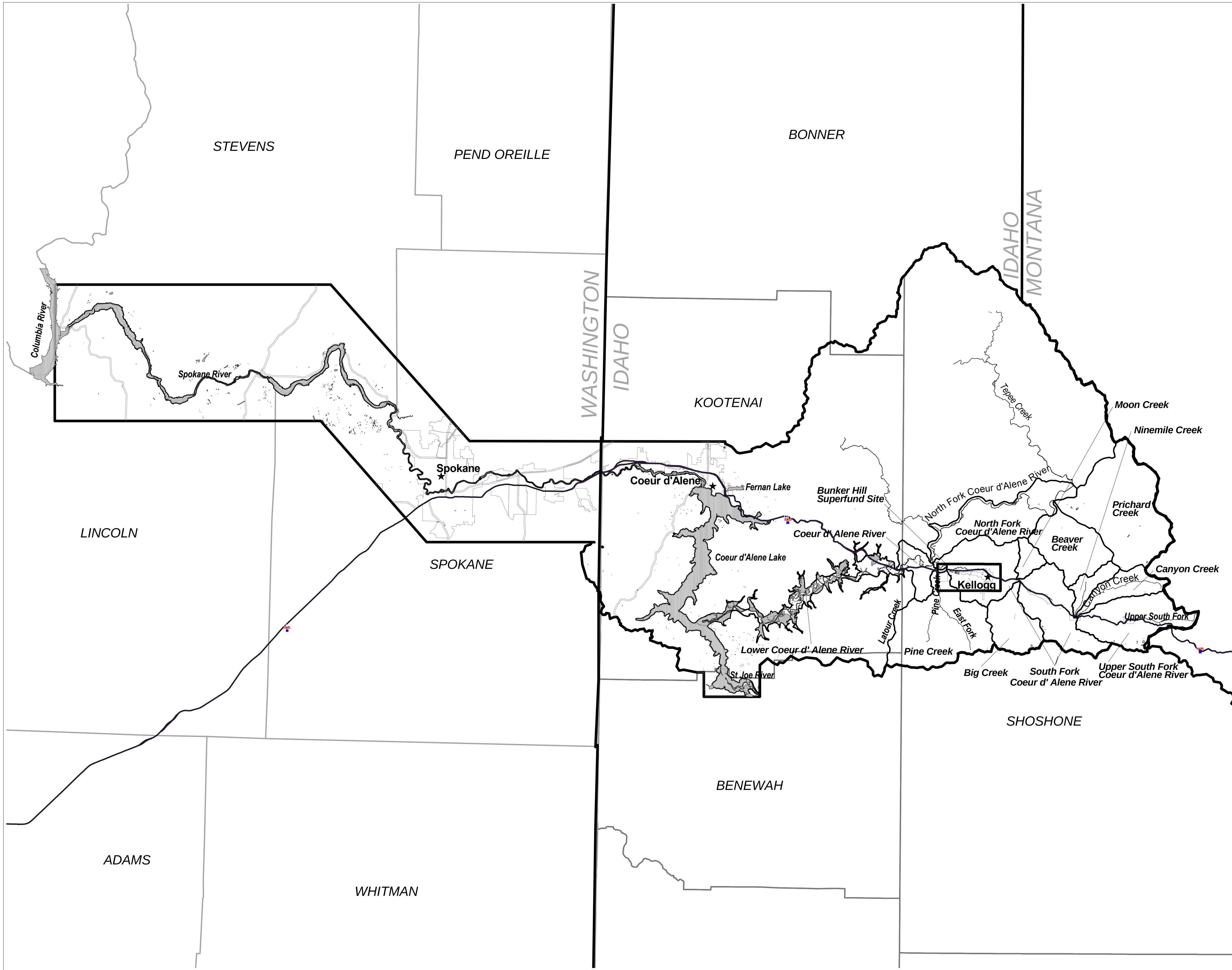
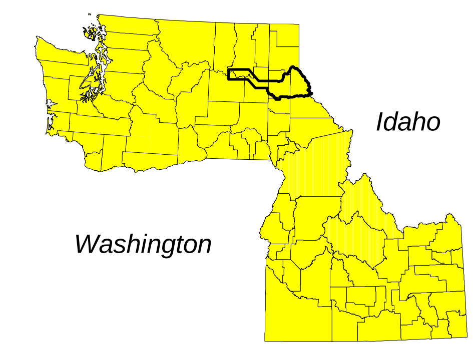


Figure 1-2
Coeur d'Alene Basin RI/FS
Watershed Boundaries

LEGEND

- Cities
- Roads
- Interstate / Highway
- Lakes and Rivers
- City Boundaries
- Watershed Boundaries
- Counties
- Bunker Hill Superfund Site



Location Map

NOTES

1) **Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management**

SCALE 1:680,000

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V: watershed bound
E: wa-id
L: Final RI Fig 1-2
7/18/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 18, 2001

2.0 SITE DESCRIPTION

The following sections provide an overview of the physical features of the basin, ecological habitats, and demographics.

2.1 PHYSICAL FEATURES

The Coeur d'Alene basin encompasses a large, diverse geographic area. From east to west, the major surface water features in the basin are the North Fork Coeur d'Alene River (North Fork), South Fork Coeur d'Alene River (South Fork), lateral lakes and wetlands associated with the main stem of the Coeur d'Alene River, Coeur d'Alene Lake, the Spokane River, Long Lake, and the Spokane arm of Lake Roosevelt. Towns in the basin include (from east to west) Mullan, Wallace, Osburn, Kellogg, Kingston, Harrison, Coeur d'Alene, Post Falls, and further west along the Spokane River the city of Spokane. Major roadways in the basin are Interstate 90, Highway 95 and Highway 3. Dams along the Spokane River include Post Falls, Upper Falls, Monroe Street, Nine Mile, and Long Lake Little Falls.

As shown in Figures 1-1 and 1-2, the eastern portion of the basin is occupied by the Bitterroot Mountains. The topography in this area is steep with deeply incised canyons that are drained by tributaries to the North and South Forks. West of the mountains the topography flattens, and wide floodplains are present along the North and South Forks. From the confluence of the North and South Forks, the main stem of the Coeur d'Alene River flows westerly and discharges into Coeur d'Alene Lake. This section of river and floodplain is rather flat, with abundant development of wetlands and small lakes. Coeur d'Alene Lake is a long, prominent linear feature in the basin. Major surface water inputs to the lake are from the Coeur d'Alene River and the St. Joe River (which discharges into the southern end of the lake). At its northern end, the lake is drained by the Spokane River that flows westerly into Washington State and eventually discharges into the Columbia River. The Spokane River is characterized by both free-flowing erosive reaches and backwaters behind dams.

Within the basin, the Coeur d'Alene mining district is located east of the confluence of the North and South Forks. The principal mines are concentrated along approximately 15 miles of the North Fork and 35 miles of the South Fork and their tributaries (USEPA 1991). Mining in these areas generated waste rock and mill tailings that contaminated the hillsides, floodplains, streams, and rivers. Over time, natural processes have continued to transport large volumes of metal contamination down the river system and deposit it in the beds and banks of the Main Stem, floodplains, Lateral Lakes, Coeur d'Alene Lake and the Spokane River.

2.2 ECOLOGICAL HABITATS

Except for portions of the Spokane River and its tributaries, the Coeur d'Alene basin is located within the Northern Rocky Mountains ecoregion of the United States. Much of the Spokane River lies along the border of the Northern Rocky Mountains and Columbia basin ecoregions. These regions are summarized as follows:

- The Northern Rocky Mountains ecoregion is characterized by rugged, high mountains with sharply crested ridges dissected by steep-walled, narrow stream valleys (Omernick and Gallant 1986). The hydrology of the region is snowmelt dominated with occasional rain or snow events.

- The Columbia basin ecoregion is characterized by deep, dry channels cut into the underlying Columbia River basalt formations. The arid landscape is composed of irregular plains, tablelands with high relief, and low mountains.

Six major habitat types are found within the Coeur d'Alene basin:

- Riverine
- Lacustrine (lakes)
- Palustrine (wetlands)
- Riparian (streambanks and floodplains)
- Upland
- Agricultural

2.3 BASIN DEMOGRAPHICS

The Coeur d'Alene basin had an early development cycle driven by the discovery of mineral deposits. As the mining declined so did the mining population and supporting business developments. The following paragraphs summarize past and present demographics.

An important aspect to development of the Coeur d'Alene basin was the rise in population in response to discovery of economic mineral deposits. The rapid start of development was evident by six different proposed plans to build railroads into the area in 1886. Starting in the late 1800s and continuing into the mid-1900s, the population increased and many communities formed near major mines or mills in the district.

Mine and mill development along the North and South Forks and the tributaries was accompanied by development of many communities. These communities became thriving centers of activity in the basin. In Wallace, there were two main line passenger trains and two freight trains running daily. Mining in Canyon Creek was substantial enough to support the Burke line which had a passenger line. Wallace had eight sidetracks with capacity sufficient to hold 275 railroad cars (Railroads in the Coeur d'Alenes, 1983). Mining activities fueled the growth of the railroad system. By the mid-1920s the use of passenger cars and busses started to impact railroad passenger service, which gradually declined.

As mining declined in the district, so did the population. Many of the mine/mill buildings, hotels and other commercial establishments and residential development evident in historic photographs are no longer standing. Most of the canyons now give the appearance of a more rural setting.

With the exception of three larger cities on Coeur d'Alene Lake and the Spokane River (Coeur d'Alene, Post Falls, and Spokane), the majority of the basin is now considered to be rural. The upper portion of the basin (CSM Units 1 to 3) has many small rural communities, primarily along the Coeur d'Alene River and its tributaries. The majority of the population of the basin lives in the cities of Coeur d'Alene and Post Falls, Idaho and Spokane, Washington, which have populations exceeding 24,000, 7,000, and 177,000 people, respectively. All the other communities in the basin have populations below 2,000. The total population of the study area is 242,262. Ninety-eight percent of the study area is in the state of Idaho (CSM Units 1-4) and the remaining 2 percent is in the state of Washington (CSM Unit 5). However, because the largest city in the basin study area, Spokane, is included in the total population of the study area, 81 percent of the study population resides in Washington and only 19 percent of the study population resides in Idaho.

3.0 CONCEPTUAL SITE MODEL AND EVALUATION METHODS

A conceptual site model (CSM) was developed to provide an initial understanding of potential site contamination and help formulate an approach to conducting the Remedial Investigation. This section summarizes the CSM and screening methods used in the remedial investigation.

3.1 CONCEPTUAL SITE MODEL

The CSM for the project was developed to convey (1) a summary of the sources of contamination, (2) mechanisms of contaminant release, (3) pathways of contaminant release and transport, and (4) ways in which humans and ecological resources in the basin are exposed to contaminants. The CSM was developed to provide a structure for assembling information about the basin and data from a variety of sources. To facilitate analysis of processes at work in the basin, portions of the basin with similar geomorphology, stream gradients and amounts and types of mining wastes were grouped into CSM units (see Part 1, Section 2 for a more complete discussion on CSM unit boundaries).

The following are the source types, release mechanisms and affected media that were identified as potentially important to the investigation of the site.

Primary source types:

- Mine workings—shafts and adits: Groundwater that enters mine workings can become contaminated through contact with various minerals within the mines.

- Waste rock: Rock derived from mining activities (not considered ore, but may be mineralized).

- Tailings: Discarded fractions of processed ores containing residual metals.

- Concentrates and other process wastes: Ore concentrates, unprocessed ore and other wastes related to mining.

- Artificial fill: Mining wastes intentionally placed as fill (e.g., for railroads, roadways and structures).

Secondary source types:

- Groundwater
- Surface water
- Suspended and bedload sediment
- Alluvium and floodplain deposits

Primary release mechanisms:

- Dissolution
- Water erosion
- Channel migration
- Wind erosion
- Mass wasting
- Chemical processes

Secondary release mechanisms:

- Chemical processes
- Water erosion
- Channel migration
- Wind erosion

Affected media:

- Groundwater
- Surface water
- Sediment
- Alluvium (soils and other materials that have been transported by water to their present location, and usually are not covered by water)
- Upland soils
- Air

Exposure routes are the pathways and processes by which humans and living natural resources (receptors) might be exposed to metals from mining waste. The selection and evaluation of risks to receptors is described in the Human Health Risk Assessment and the Ecological Risk Assessment (both published under separate cover). As discussed in the Human Health Risk Assessment, air was not found to be a significant pathway (Terragraphics 2000).

Sources, release mechanisms, affected media, exposure routes and potential receptors are illustrated in Part 1, Section 2 for the Coeur d'Alene River and tributaries, Coeur d'Alene Lake, and the Spokane River.

3.2 EVALUATION METHODS

The initial methods used to evaluate chemical and physical data compiled in the remedial investigation are presented in this section. Methods include (1) determination of pre-mining metal background concentration ranges, (2) identification of the chemicals of potential concern (COPCs), (3) selection of risk-based screening levels, and (4) calculation of mass loading.

3.2.1 Determination of Background Metals Concentrations

A primary purpose of the RI was to identify areas within the Coeur d'Alene basin that are contaminated by mining wastes. Contaminated areas can be determined by comparing concentrations of metals in environmental media (soil, sediment, and water) with concentrations that are likely to be naturally occurring. Those naturally occurring concentrations (not influenced by mining contamination) are called "background concentrations." Once established, background concentrations can also be used to assist in the selection of remedial goals or target clean-up levels when used in conjunction with risk-based values determined through human health and ecological risk assessments.

Sufficient data were available for soil, sediment, and surface water to develop background concentrations. Sufficient data were not available to develop background concentrations for groundwater. To determine which portions of the Coeur d'Alene basin should be considered contaminated and, therefore, evaluated in the feasibility study, concentrations of metals in environmental media were compared with background values and risk-based benchmarks.

Background concentrations derived for use in the remedial investigation for the ten chemicals of potential concern are discussed in Part 1, Section 5.2, and are summarized in Table 3.2-1. Background concentrations for soil and sediments represent the 90th percentile concentration. Background concentrations for surface water represent the 95th percentile concentration.

3.2.2 Chemicals of Potential Concern and Screening Levels

Based on preliminary results of the human health and ecological risk assessments, 10 COPCs were identified for inclusion and evaluation in the remedial investigation. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Part 1, Section 5.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level. Groundwater data were screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data were evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results. Therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results. Therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Selected screening levels are listed in Tables 3.2-2 through 3.2-4.

For evaluation of the nature and extent of the 10 chemicals of potential concern in site soil, sediment, groundwater, and surface water, data were compared to 1x, 10x, and 100x the screening levels.

Screening levels were used in the remedial investigation to help identify source areas and affected media that were carried forward for evaluation in the FS.

Table 3.2-1
Selected Background Concentrations for Metals in the Basin

Media[a,b]	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Upper Coeur d'Alene River Basin										
Soils	5.8	22	2.7	53	65,000	171	3,597	0.3	1.1	280
Sediments	3.3	13.6	1.56	32.3	26,000	51.5	1,210	0.179	1.1[c]	200
Lower Coeur d'Alene River Basin and Coeur d'Alene Lake										
Sediments	1.63	12.6	0.678	25.2	27,600	47.3	325	0.179[d]	0.324	97.1
Spokane River Basin										
Sediments	1.63[e]	9.34	0.72	23.9	25,000	14.9	663	0.032	0.324[e]	66.4
Coeur d'Alene River and Spokane River										
Surface Water	2.92	0.91	0.38	1.48	46.8	1.09	20.4	0.66	0.14	24.2

[a]All soil and sediment concentrations in mg/kg (milligrams per kilogram); all surface water concentrations in µg/L (micrograms per liter).
[b]Data sources:
- Upper Basin Soils: 90th percentile from Gott and Cathrall (1980) data
- Upper Basin sediments: 90th percentile estimated from RI/FS data
- Lower Basin sediments: 90th percentile estimated from RI/FS data
- Spokane River Basin sediments: 90th percentile of Ecology soil background data (WDOE 1994)
- Surface water: 95th percentile estimated from RI/FS data

[c]A range of background concentrations for silver in Upper Basin sediments could not be estimated because most values were below reporting limits. Therefore, the value for silver in soil has been selected recognizing that this value is biased high.
[d]A range of background concentrations for mercury in Lower Basin sediments could not be estimated because most values were below reporting limits. Therefore, the value for mercury in Upper Basin sediments has been selected recognizing that this value is biased high.
[e]No Ecology data were available for antimony and silver in Spokane River Basin sediments. Therefore, the Lower Basin sediment values were selected recognizing that these values are biased high.

Table 3.2-2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (μg/L)	Surface Water Dissolved (μg/L)	Groundwater Total (μg/L)	Groundwater Dissolved (μg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e,f]	0.38[b]	2[e,f]	0.38[b]
Copper	1[e,f]	3.2[c,d]	1[e,f]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e,f]	42[c,d]	30[e,f]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column. Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.
[f]Value based on protection of aquatic plants.

Note:
μg/L - microgram per liter

Table 3.2-3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e,f]	0.38[b]	2[e,f]	0.38[b]	2[e,f]	0.38[b]
Copper	1[e,f]	2.3[c,d]	1[e,f]	3.8[c,d]	1[e,f]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e,f]	30[c,d]	30[e,f]	50[c,d]	30[e,f]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of $CaCO_3$) in the water column. Value for segments Spokane RSeg01, -02, and -03 calculated using hardness values of 20, 37, and 59 mg/L $CaCO_3$, respectively.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.
[f]Value based on protection of aquatic plants.

Note:
µg/L - microgram per liter

Table 3.2-4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin Soil (mg/kg)	Upper Coeur d'Alene River Basin Sediment (mg/kg)	Lower Coeur d'Alene River Basin Soil (mg/kg)	Lower Coeur d'Alene River Basin Sediment (mg/kg)	Spokane River Basin Soil (mg/kg)	Spokane River Basin Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram

4.0 PHYSICAL SYSTEM AND MINING IMPACTS

Early mine development was clustered in areas where the mineral belts crossed through the canyons. The initial sources of metals contamination consisted of waste rock dumps adjacent to adits and groundwater drainage discharged from the adits. As mine production increased, ore was hauled to mills which were usually constructed near sources of water. The mills originally produced a mix of fine- and coarse-grained jig tailings. Later refinements in ore processing led to the generation of progressively finer-grained flotation tailings and progressively lower metal concentrations in the mine wastes.

The present day distribution of mining wastes reflects the past mining and milling practices. Large waste rock dumps, which are evident throughout the canyons, are a source of metal contamination. While early jig tailings can be observed mixed in with some of the waste rock dumps, the majority of the jig and flotation tailings were discharged into the stream system near the mills. Over time this material was mixed with the soils and sediment and transported downstream in the canyons, through the South Fork and the Coeur d'Alene River. The floodplains are now considered to be the major source of contamination in the basin. The finer-grained material continues to be transported all the way downstream into the lateral lakes area, Coeur d'Alene Lake and some even into the Spokane River.

Surface water transport has distributed mining wastes throughout much of the alluvium along the South Fork, its tributaries, lateral lakes area, Coeur d'Alene Lake, and the Spokane River. Floodplain contamination differs from the highly visible nature of waste rock piles dumped near the mines. The mining waste in the floodplain is present throughout much of the alluvium and floodplain sediments and extends under roads and towns constructed in the floodplains. This material represents a very large, dispersed source of metal contamination. The metal contamination tends to migrate in surface water and groundwater. Depending on the changing chemistry of the water, metals in the alluvium can be precipitated and/or re-dissolved. Very fine-grained and colloidal material continues to be transported down the Spokane River to the Columbia River.

This section does not attempt to summarize all aspects of the very complex physical system that exists in the basin today. Rather, it presents only the primary aspects that support the evaluation of the nature and extent and fate and transport of metal contamination. Summary information on groundwater, surface water, geology, ore deposits, mining, mine-waste generation, contaminant concentrations and mass loading are presented by watershed in Table 4-1.

4.1 GEOLOGY/GEOCHEMISTRY

The geology, geochemistry, ore deposits and mining practices are all interrelated in the generation and distribution of contamination. As shown in Part 1, Figure 3.2-3, the mineralization (mineral belts) in the mining district tends to cut across many of the canyons that are tributaries of the South and North Forks. The mineral belts trend west-northwest, roughly parallel the valley of the South Fork.

The rock in which veins occur in the basin is bedrock of the Belt Supergroup. It is comprised of six geologic formations. The formations are the Striped Peak, Wallace, St. Regis, Revett, Burke and Prichard.

The formations and their respective geochemistry play a major role in shaping the upper basin topography and acting as hosts for the ore deposits. The presence of carbonate and sulfide minerals in the formations were identified as two of the primary mechanisms that directly affect water chemistry and control the migration of metals. The carbonate and sulfide minerals are subject to natural weathering processes (oxidation and dissolution) which are exacerbated by mining and milling which fractures the host rock and exposes much greater surface areas to oxidation. Metal sulfide oxidation, primarily iron pyrite, creates acidic conditions (lowers pH) which in turn increases the solubility and dissolution of other sulfide minerals. This permits dissolved cadmium, iron, lead, zinc, and other heavy metals to contaminate surface and groundwater. Carbonates can act to increase pH, which tends to precipitate certain heavy metal compounds (secondary minerals). Depending upon pH and other conditions, waters can contain both dissolved and particulate metals. Particulate metals occur as metals adsorbed onto precipitated iron. Under pH conditions observed in surface water in the Basin, cadmium and zinc are in the dissolved phase, while lead has a higher fraction in the particulate phase.

Carbonate minerals, usually ferrous dolomite and less commonly calcite, may be found in all formations, but are common only in the Wallace formation and to a lesser extent in the St. Regis and Striped Peak formations (Hobbs et al. 1965). The presence of the primary minerals is summarized as follows:

- **Prichard Formation:** The sulfide content is typically higher in close proximity to ore deposits or large masses of igneous rocks (i.e. Gem Stock). The formation is comprised of argillite which has little carbonate material.

- **Burke Formation:** Carbonate-rich strata are locally present but constitute only about 1 percent of the total volume. Sulfides are not present in appreciable quantities unless in close proximity to ore deposits or igneous rocks.

- **Revett Formation:** Carbonate-bearing quartzites are locally present but do not constitute a significant percentage of the total volume of quartzite in the formation. Sulfides are not reported unless in close proximity to ore deposits or igneous rocks.

- **St. Regis Formation:** Sulfides are not reported in the St. Regis, unless in close proximity to ore deposits or igneous stocks. The upper portion of the formation contains some carbonate-bearing beds.

- **Wallace Formation:** There are by far more carbonate-bearing rocks in the Wallace than in the other formations of the Belt Supergroup. Both quartzite and argillite layers are frequently carbonate bearing. The carbonate mineral calcite is present, but probably the most abundant carbonate mineral is an iron-rich dolomite, which stands out because of the rusty red or brown stain on weathered surfaces (particularly quartzite). Sulfides are not reported in the Wallace Formation, unless in close proximity to ore deposits or igneous stocks (Hobbs et al. 1965).

- **Striped Peak Formation:** Sulfides are not reported in the Striped Peak Formation, unless in close proximity to ore deposits or igneous stocks (Hobbs et al. 1965). The basal portion of the formation lies within the mining district. It is reported to have some interbedded dolomite.

4.2 ORE DEPOSITS

Ore deposits in the district generally occur as steeply dipping veins in formations of the Belt Supergroup. Most of the veins range in width from a fraction of an inch to 10 feet, and occasionally up to 50 feet wide. In general, the type, grade and location of the deposits do not seem to be affected by depth (Hobbs and Fryklund 1968). Individual ore shoots (i.e., ore-bearing zones within the veins) range in length from a few tens of feet to more than 4,000 feet. Their dip length is usually several times the strike length, and generally they rake steeply in the plane of the vein (Hobbs and Fryklund 1968). Ore minerals are the components of an ore rock that are economically feasible to extract. The primary ore minerals are galena (lead sulfide [PbS]), sphalerite (zinc sulfide [ZnS]), and argentiferous tetrahedrite (an arsenic-antimony sulfide with varying proportions of copper, iron, zinc, and silver). The non-ore minerals associated with mineral deposits consist primarily of quartz (SiO_2) and siderite, an iron carbonate ($FeCO_3$).

There are three general types of vein deposits in the district (Bennett and Venkatakrishnan 1982):

- Deposits in the middle Prichard quartzites (zinc-lead orebodies on Pine Creek)
- Deposits in the Prichard-Burke transition zone (Ninemile Creek and Canyon Creek lead-zinc deposits)
- Deposits in the Revett-St. Regis transition zone (Bunker Hill Mine, Star-Morning Mine, Lucky Friday Mine, and the mines in the Silver Belt)

There is abundant evidence that zones (or halos) of carbonate, primarily disseminated siderite (i.e., iron carbonate), are present around many of the veins of the district. Weathering of these carbonate zones may produce more alkaline stream waters (and probably more alkaline groundwater), with relatively high amounts of iron and lesser amounts of calcium and magnesium. However, alkalinity from carbonate zoning may be buffered by acidic waters generated from sulfide-rich zones around many veins in the district.

Zones of disseminated galena, sphalerite, arsenopyrite, and pyrite are also found around many of the orebodies in the district (White 1998). The weathering of the disseminated sulfides around the veins could produce waters that contain elevated concentrations of metals, at least in areas where there is not sufficient dilution from nonmineralized rock (Stratus 1999).

Throughout the district, most of the ore is associated with quartzite layers in the Belt Supergroup rocks. The Revett quartzite accounts for approximately 75 percent of the ore production; 19 percent is from the quartzite at the Burke-Prichard transition zone; and all current production is from the Revett-St. Regis boundary (White 1998). Table 4-1 identifies the geologic formations and ore minerals that are present in the various canyons.

4.3 MINING PRACTICES

Early in the development of the district, the extracted vein material was hand-sorted to separate rock with no current economic value (waste rock) from ore containing lead and silver. The ore was further separated into ore that could be shipped directly to smelters and ore that would require concentration prior to shipment to the smelter. Mining activity by watershed is summarized in Table 4-1. As shown in the table, all the listed watersheds in the upper basin had producing mines. Recorded ore production figures indicate that the South Fork followed by Canyon Creek and the Upper South Fork were the highest producers. These three watersheds had the highest volume of tailings produced.

An estimated 54.5 to 70 million tons of tailings (see Section 1.0) were discharged to streams from the beginning of ore processing in 1884 until discharge of tailings to streams was discontinued in 1968. The tailings contained an estimated 880,000 tons of lead and more than 720,000 tons of zinc (Long 1998). Table 4.3-1 summarizes the quantities of mill tailings and metals disposed in various settings. In addition to tailings, mining activities generated a large quantity of waste rock. The waste rock was usually dumped near the mine adit. Railroad lines were also constructed using tailings and waste rock as ballast. On the order of 12 million cubic yards are present in CSM 1 and 2, excluding the BHSS. As mining and milling techniques improved, the character of the waste generated in the district changed. Table 4.3-2 briefly summarizes the history of milling and tailings disposal in the basin.

Discharge of metals-impacted water from adits is an ongoing source of metals contamination in the basin. Discharge from 110 adits has been documented within CSM Units 1 and 2, not including the BHSS (Gearheart et al. 1999). The Kellogg Tunnel, located within the BHSS, is the largest single adit source of metals. The discharge from the Kellogg Tunnel is treated for metals removal at the Central Treatment Plant prior to discharge to the South Fork.

When comparing mass loading data presented in Table 4-1, it is evident that ore production or tailings production may not be a good indicator of impacts to surface water. Canyon Creek has an estimated expected (average) dissolved zinc load of 714 pounds per day compared to 89.4 pounds per day in the Upper South Fork while the tailings volumes produced in the two watersheds were fairly comparable. Additional evaluation of individual sources in these watersheds will need to incorporate the position of the source material relative to the floodplain, type of source material present, milling method used and geochemistry of the rock. The metal contamination mixed in the floodplain sediments and alluvium makes a substantial contribution to metal loads downstream from mill sites.

4.4 GROUNDWATER

The character of groundwater flow in the unconfined aquifer system in the basin changes from the mountainous region of the basin down to Coeur d'Alene Lake and then the Spokane River.

Groundwater flow in the unconfined shallow aquifer system is considered an important pathway in the basin for contaminant migration in the South Fork and its tributaries. Fracture flow in bedrock contributes some recharge to the overlying unconfined aquifer system. However, the contribution of metal contamination from bedrock fractures or faults is expected to be localized to the intersection with mine workings. Currently, there is little information available on fracture flow and contaminant migration. The following discussion of groundwater in the basin focuses on the unconfined water-table aquifer system.

4.4.1 Tributaries to the North and South Forks

Unconfined aquifers in tributaries to the North and South Forks vary greatly in thickness and width. These factors are usually controlled by the depth to bedrock. The source of groundwater recharge to tributary aquifers is a combination of precipitation, snow melt, surface water and, in some cases, mine working discharge. In general, the grain size of aquifer material is coarse but extremely variable. Consequently, the hydraulic conductivity, or the ability of the aquifer to transmit water, is high. Calculated hydraulic conductivity in Canyon Creek ranged from 20 to 200 feet per day. A similar range of hydraulic conductivities is expected in the other tributary aquifers. In the lower portions of some canyons, such as Canyon Creek, two unconfined (or semi-confined) aquifers may be present (the alluvial aquifer and the bedrock aquifer). In such cases, the upper, or shallower aquifer, appears to be the most important for the transport of metal contamination.

Gradients in the tributary aquifers tend to be steep and similar to the topographic gradient. Given the high hydraulic conductivity and the cyclic nature of precipitation, the water table elevations are also highly variable. Subsurface materials that fall between the high and low water table elevations will be subject to cyclic wetting and drying. In sections of the canyons where floodplain source areas have been identified, there will be an increased leaching of metals into groundwater.

Groundwater in the canyons is very interactive with the surface water. Surface water and groundwater interaction is very dependent on the depth to bedrock and width of the floodplain. Many sections of the canyon streams investigated were either losing water to or gaining water from the underlying aquifer. This relationship was studied in detail by the USGS (Barton 2000). Their conclusions confirm that surface water tends to discharge to groundwater where the floodplain widens whereas when the floodplain narrows, groundwater discharges to surface water. Based on surface water mass loading data, this condition appears common in the tributaries. This is discussed further in Section 5.

At the mouth of some tributaries such as Canyon Creek or Ninemile Creek bedrock is very shallow. Where this condition is present, groundwater is forced upward and discharges into surface water. The volume of groundwater discharging to the South Fork is lowered along with the metal mass load. This is offset by an increase in volume and metal mass load in surface water which discharges to the South Fork.

4.4.2 North and South Forks

The North and South Fork valleys are underlain by what appears to be continuous and somewhat uniform two-aquifer system. Information on subsurface conditions in the valleys is limited. Very little information was available on subsurface conditions in the North Fork; however, the presence of alluvium over bedrock is observed in areas of the North Fork, similar to that observed and confirmed by soil borings in areas of the South Fork and its tributaries. As in the tributaries, the upper, or shallow, aquifer appears to be more important in the transport of metal contamination. Therefore, the following discussion focuses on the available information for the South Fork.

Overall the thickness of unconsolidated material overlying bedrock ranges from about 30 feet near Wallace to about 410 feet at Rose Lake. East of Wallace, there appears to be a single unconsolated aquifer present. In general, the water table in the upper aquifer is about 10 feet below the ground surface. As in tributary aquifers there is a zone of subsurface material that is subject to a wetting and drying cycle. Periods of highest recharge in the spring correspond to the shallowest water table conditions.

Groundwater gradients along the South Fork are lower than in the tributaries but transmissivities are high. In the BHSS the upper aquifer hydraulic conductivity ranged from 500 to 11,000 feet per day. The estimated groundwater flow in the upper unconsolated aquifer was about six cubic feet per second. Many sections of the stream system are losing water to or gaining water from the underlying aquifer. The USGS investigation (Barton 2000) documents these conditions in the Osborn Flats area. This condition is expected to occur along many sections of the South Fork.

The wide floodplain observed along many sections of the South Fork, coupled with the large estimated volume of mill tailings known to be mixed with the alluvium, presents a condition of continued metal loading to groundwater and surface water. Based on mass loading data and flow data, metals will continue to be transported by groundwater with a high degree of interaction with surface water. This is discussed further in Section 5.

Available information on groundwater and surface water interactions in the portion of the Spokane River from State Line, Idaho to Spokane, Washington, indicates that water is lost to the aquifer in the upper portion and water is gained by the river in the lower portion. Discharges are highly dependent on in-stream flow and regulation of the river by the Upriver and Post Falls dams.

4.4.3 Main Stem and Lower Coeur d'Alene River

There is little information on groundwater conditions in the Main Stem. It is assumed that conditions are similar to that described for the South Fork. Further west however the character of the aquifer transitions to fine-grained sediment. The aquifer is comprised of mostly silts and clays. Groundwater gradients are very low and groundwater flows slowly. Groundwater is a concern where it discharges to the river from contaminated bank and floodplain sediments. Groundwater will need to be considered in the lateral lakes area as a continuing source of metal contamination to the river.

4.4.4 Coeur d'Alene Lake and Spokane River

Both the Lower Coeur d'Alene River and aquifer system discharge to Coeur d'Alene Lake. Over most of its extent, Coeur d'Alene Lake is a regional groundwater discharge zone. However, at its northernmost end, the lake is a primary source of recharge into the Rathdrum Prairie aquifer.

A large number of hydrogeologic investigations and studies have occurred in the upper reaches of the river basin above Long Lake where extensive and highly productive glacial outwash aquifer system (the Spokane Valley/Rathdrum Prairie Aquifer) is present. This aquifer is the major source of drinking water for the cities of Spokane, Post Falls and Coeur d'Alene, and for residents within the Spokane Valley area.

Little information is available on metal transport in groundwater around the lake and along the upper portion of the Spokane river. However, groundwater is not expected to be a major pathway for metal migration in these areas.

4.5 SURFACE WATER AND SEDIMENT TRANSPORT

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movement incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment. Sediment is generally incorporated and transported as suspended load (smaller particles that travel in the flowing water) or bedload (larger particles that travel along the bottom of the channel) during the high-flow stream discharges during spring and summer snowmelt. The quantity of the sediment transported typically increases as stream discharge increases, as does the particle size moved. Even during low-flow conditions, some sediment transport occurs as very fine particles that are kept in suspension by moving water.

The primary physical mechanism responsible for the transport of metal contamination in the basin is surface water flow coupled with sediment mobilization and transport. The CSMs encompass approximately 1,500 square miles with 810 miles of mapped stream channel in the Coeur d'Alene River basin. The drainage density ranges from approximately 0.4 to 1.0 mile per square mile. This density is relatively constant throughout the basin. Contaminated sediments transported in the Coeur d'Alene River basin are derived from bank erosion, channel migration, bed material remobilization, and sediments from debris deposits adjacent to stream channels. Summary information on surface water and sediment is presented in Tables 4-1 and 4.5-1.

In the upper Coeur d'Alene River tributaries (e.g., Canyon Creek), high gradients (slope) and often confined channels limited the capacity to store sediment; therefore, these areas produce occurs much of the sediment transported by the overall system. Some sediment storage occurs in areas in the upper basin where there were developed floodplains (i.e. Woodland Park) in contact with the stream channel.

In the South Fork, lower gradients allow for more sediment to be stored (e.g., Osburn flats) than in the tributaries. In areas where the channel has not been channelized or banks protected, the channels often displayed a meandering and braided channel form. These braided channels may deposit sediment in one area while incorporating sediment from another area. As with the tributaries, the quantity of sediment transported, as well as the particle size, increases at larger stream discharges but some sediment transport was found to occur at low discharges. Sediment sources in the South Fork are from bank erosion, channel migration, channel bed material remobilization, and sediment from the upper watersheds and tributary streams.

In the Lower Coeur d'Alene River, which consists of a broad floodplain with numerous lakes and wetlands adjacent to the channel, the gradient of the channel is very low. The many wetlands, lakes and broad floodplains in this section of the river provide abundant storage for storm water. These areas store water during large discharges and mute peak discharges at downstream locations. Due to the low gradient, this section of the river does not transport appreciable quantities of gravel; however, sand, silt, and clay-sized particles are transported. Storage of sediment occurs in the broad floodplain, wetland, and lakes adjacent to the channel. The quantity of sediment transported increases at higher discharges, with some sediment load transported at even lower discharges. Sediment sources in the Lower Coeur d'Alene River include bank erosion, channel bed remobilization and sediment from the upper watersheds, tributary channels, and the South Fork. Channel migration does not appear to be a significant source of sediment as the channel alignment has been relatively constant since development has limited channel migration. Prior to development, the channel did migrate.

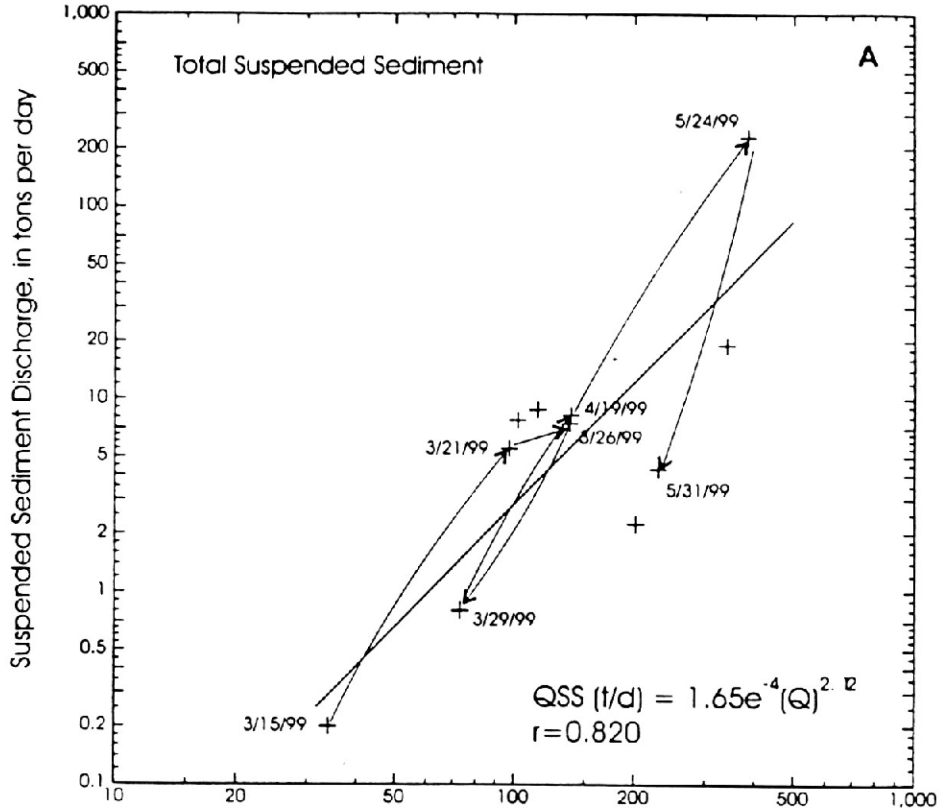
Little sediment is transported through Coeur d'Alene Lake except during high-flow events. The majority of sediment entering the lake is deposited as deltas at the mouth of each tributary. Most of the fine material carried in by the Coeur d'Alene River is deposited in the lake before the water exits via the Spokane River.

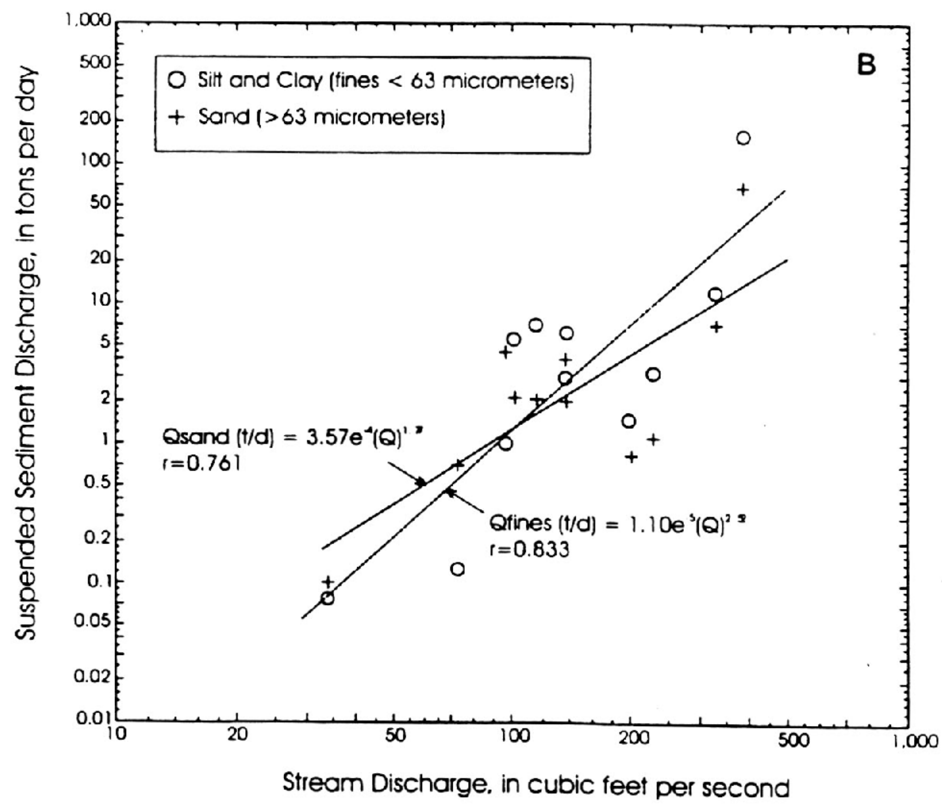
Free-flowing segments of the Spokane are noted for their lack of fine sediments and the river's "armored" gravel and cobble-dominated bed surface. Fine-grained, metals-laden sediments that may be deposited within the interstitial spaces of the tightly packed armored substrate of the riverbed throughout its shallow reaches are not readily accessible, nor are they believed to represent significant quantities potentially available for remedial considerations. Fine sediments do, though, locally accumulate in lower energy eddies along the shorelines, as bars and beaches within the braided segment of the river near Stateline, in backwater pockets, and in reservoirs created by the dams along the river. Upstream of Hangman Creek, a limited amount of sediment accumulates in the river channel because relatively little sustained fine-grained load is transported into, or is residing in the river. Below the confluence with Hangman Creek, substantial suspended sediment mass is introduced and fine-grained pronounced sediment accumulates behind down-river dams, particularly Long Lake.

The discharge of fine-grained particles is typically controlled by the available supply of such particles and the supply is often less than the stream can transport (Colby 1956). These fine-grained sediments move downstream with the same velocity as the water transporting them. In contrast to fine-grained sediments, the supply of coarse-grained sediments in streams is generally greater than the stream can transport. Thus, the discharge of coarse-grained sediments is typically controlled by the ability of the stream to transport them (Guy 1970). Bedload material may move only occasionally (e.g. during seasonal high flows or flood events) and is generally stable.

As mentioned above, increased stream discharge typically results in increased quantities of suspended sediment because of the increased energy available for sediment mobilization. Accordingly, varying quantities of sediment are transported depending on the stream discharge rate. To estimate the quantity of sediment transported at varying stream discharge rates, stream discharges verses sediment loads were plotted on log-log paper and a regression curve was fit to the data relating sediment load to stream discharge by Clark and Woods (2000). An example of such a sediment-rating curve is shown in Figure 4.5-1 for Canyon Creek above the mouth at Wallace. Figure 4.5-1 contains regression lines for the total sand-sized (>63 µm) and fine-sized (<63 µm) suspended sediments as a function of the discharge rate in cubic feet per second. Similar sediment rating curves were developed for a total of eight locations.

The sediment rating curves were used to estimate the suspended and bedload sediment loads transported (Table 4.5-1) under varying flow regimes for the seven locations for which data were available. The discharge rates selected represent the 10th and 90th percentiles and the estimated expected (average) discharges. The estimated expected discharges are those values calculated using statistical methods described in Part 1, Section 5.4.2, and in a separate technical memorandum developed in support of the RI/FS (URS 2001). The 10th and 90th percentile discharges were TMDL discharges when available. That is, the discharges of the 10th and 90th percentile were used as presented in the TMDL technical support document of August 2000 (USEPA). The findings of sediment erosion and stream transport are discussed further in Section 5.





Source: Clark and Woods 2000

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc. Control:4162500.6615.05.a Generation: 1 RI700 110200	**Figure 4.5-1** **Sediment Transport Curves for Total Suspended Sediment, Suspended Sediment and Clay, and Suspended Sand at Canyon Creek Above the Mouth at Wallace, Water Years 1999 and 2000**

Table 4-1
Summary of Hydrology, Hydrogeology, Mine Production, Surface Water Concentrations, and Mass Loading

Watershed	Area (square miles)	Mapped Main Channel Length (miles)	Baseflow (cfs)	Annual Average Discharge (cfs)	Estimated Expected (Average) Discharge[b] (cfs)	Max. Mean Daily Discharge (cfs)	Identified Aquifers	Hydraulic Conductivity (ft/day)
North Fork and Tributaries								
Prichard Creek (PR14)	97.8	45	15 to 20	225	534 (cv = 2.88)	1,750	Bedrock; Shallow Alluvial	NA
Beaver Creek (all locations)	44.1	12	5 to 10	100	Not Available	790	Bedrock; Shallow Alluvial	NA
North Fork CdA River (NF50)	62	28	200 to 250	1,900	1,660 (cv = 1.68)	50,000	Bedrock; Shallow Alluvial	NA
South Fork and Tributaries								
Upper South Fork (SF228)	50	13.3	30 to 40	133	114.6 (cv = 1.32)	2,450	Shallow Alluvial	NA
Canyon Creek (CC287/288)	21.9	11.7	3 to 5	60	53.4 (cv = 1.15)	1,320	Bedrock; Shallow Alluvial	20 to 200
Ninemile Creek (NM305)	11.6	9.5	3 to 5	18.7	19.8 (cv = 1.31)	540	Bedrock; Shallow Alluvial	90 to 120
Big Creek (BC260)	29.9	12.8	5 to 10	88.6	Not Available	1,800	Bedrock; Shallow Alluvial	NA
Moon Creek (MC262)	9	3.8	1 to 2	9	13.2 (cv = 2.11)	56	Bedrock; Shallow Alluvial	NA
Pine Creek (PC305)	79.6	10.2	20 to 30	190	215 (cv = 2.94)	4,650	Bedrock; Shallow Alluvial	NA
South Fork CdA River (Pinehurst) (SF271)	97	18.9	90 to 100	540	533 (cv = 1.37)	9,000	Confined alluvial sediments (lower); unconfined alluvial sediments (upper)	500 to 11,000 (upper aquifer)
Coeur d'Alene River								
Coeur d'Alene River (Harrison) (LC60)	43.7	35.7	500	2,630	2,810 (cv = 1.42)	66,793	Bedrock; Shallow Alluvial	NA
Coeur d'Alene Lake								
Coeur d'Alene Lake (Post Falls) (SR50)	70	NA	1,400	6,270	7,530 (cv = 1.62)	NA	Rathdrum Prairie	NA
Spokane River								
Spokane River (Long Lake) (SR85)	34.7	110	NA	7,810	8,120 (cv = 0.845)	NA	Rathdrum Prairie	NA

Table 4-1 (Continued)
Summary of Hydrology, Hydrogeology, Mine Production Surface Water Concentrations, and Mass Loading

Watershed	Transmissivity (gpd/foot)	Number of BLM Source Areas	Number of Producing Mines	Number of Mills	Ore Produced (tons)	Tailings Produced (tons)	Prevalent Geologic Formations
North Fork and Tributaries							
Prichard Creek (PR14)	NA	58	9	10	636,000	497,000	Prichard
Beaver Creek (all locations)	NA	74	12	1	2,138,000	1,974,000	Prichard; Wallace; Burke; Revett
North Fork CdA River (NF50)	NA	3	0	0	0	0	Prichard; Burke; Revett; St. Regis; Wallace
South Fork and Tributaries							
Upper South Fork (SF288)	NA	229	11	6	24,464,000	19,911,000	St. Regis; Wallace
Canyon Creek (CC287/288)	1,900 to 13,000	125	21	12	34,800,000	27,436,000	Prichard; Burke
Ninemile Creek (NM305)	NA	70	8	7	4,960,000	4,060,000	St. Regis; Revett; Wallace
Big Creek (BC260)	NA	71	4	2	12,435,000	11,022,000	St. Regis; Revett; Wallace
Moon Creek (MC262)	NA	14	2	1	4,600	3,800	Prichard; Burke
Pine Creek (PC305)	NA	131	14	10	3,160,000	1,634,000	Prichard
South Fork CdA River (Pinehurst) (SF271)	NA	294	25	4	44,405,000 (upstream of Elizabeth Park); 47,839,000 (downstream of Elizabeth Park)	40,922,000 (upstream of Elizabeth Park)	Prichard; Burke; Revett; St. Regis
Coeur d'Alene River							
Coeur d'Alene River (Harrison) (LC60)	NA	0	0	0	0	0	NA
Coeur d'Alene Lake							
Coeur d'Alene Lake (Post Falls) (SR50)	NA	0	0	0	0	0	NA
Spokane River							
Spokane River (Long Lake) (SR85)	NA	0	0	0	0	0	NA

Table 4-1 (Continued)
Summary of Hydrology, Hydrogeology, Mine Production Surface Water Concentrations, and Mass Loading

Watershed	Principal Ore Minerals	Sulfide Minerals (%)	Carbonate Minerals (%)	Sediment Yield Water Year 1999 (tons)	Estimated Expected (Average) Dissolved Cadmium Concentration (μg/L)[b]
North Fork and Tributaries					
Prichard Creek (PR14)	Galena	Minimal	Minimal	NA	**0.42** (cv = 0.686)
Beaver Creek (all locations)	Galena (Ag,Pb); Sphalerite (Zn)	Pyrite; Pyrrhotite (3-5)	Siderite; ankerite (3-5)	NA	**3.7** (calculated average)
North Fork CdA River (NF50)	Minimal	Minimal	Minimal	25,400	NA
South Fork and Tributaries					
Upper South Fork (SF288)	Galene; sphalerite; tetrahedrite; chalcopyrite	Pyrite; Pyrrhotite (2-3)	Siderite; barite; calcite; magnetite (high relative to other watersheds)	2,400	**1.07** (cv = 0.455)
Canyon Creek (CC287/288)	Galena; sphalerite	Pyrite; galena	Siderite	1,358	**17.6** (cv = 1.05)
Ninemile Creek (NM305)	Galena; sphalerite	Pyrite (3-5)	Minimal	397	**22** (cv = 0.48)
Big Creek (BC260)	Galena; tetrahedrite; sphalerite; chalcopyrite	Arseno-pyrite; pyrite	Ankerite; siderite	1,443	**1** (max. detected)
Moon Creek (MC262)	Galena; sphalerite	Pyrite; Pyrrhotite	?	NA	**0.68** (cv = 0.33)
Pine Creek (PC305)	Galena; sphalerite	Pyrite	Ankerite	2,923	**0.538** (cv = 2.68)
South Fork CdA River (Pinehurst) (SF271)	Galena; siderite	Pyrite	?	21,930	**9.08** (cv = 0.629)
Coeur d'Alene River					
Coeur d'Alene River (Harrison) (LC60)	NA	NA	NA	50,150	**1.92** (cv = 0.371)
Coeur d'Alene Lake					
Coeur d'Alene Lake (Post Falls) (SR50)	NA	NA	NA	NA	NA
Spokane River					
Spokane River (Long Lake) (SR85)	NA	NA	NA	NA	NA

Table 4-1 (Continued)
Summary of Hydrology, Hydrogeology, Mine Production Surface Water Concentrations, and Mass Loading

Watershed	Estimated Expected (Average) Total Lead Concentration (µg/L)[b]	Estimated Expected (Average) Dissolved Zinc Concentration (µg/L)[b]	Estimated Expected (Average) Dissolved Cadmium Mass Loading (lbs/day)[b]	Estimated Expected (Average) Total Lead Mass Loading (lbs/day)[b]	Estimated Expected (Average) Dissolved Zinc Mass Loading (lbs/day)[b]
North Fork and Tributaries					
Prichard Creek (PR14)	3.54 (cv = 2.02)	31.2(cv = 0.30)	0.874 (cv = 2.34)	42.7 (cv = 28.9)	83.6 (cv = 2.8)
Beaver Creek (all locations)	3.4 (calculated average)	**621** (calculated average)	Not Available	< 1 (measured)	24 (measured)
North Fork CdA River (NF50)	2.13 (cv = 2.1)	10.1 (cv = 0.94)	Not Available	**98** (cv = 11.6)	239 (cv = 3.11)
South Fork and Tributaries					
Upper South Fork (SF288)	9.21 (cv = 0.902)	**188** (cv = 0.741)	0.504 (cv = 1.05)	**8.22** (cv = 3.9)	**89.4** (cv = 1.23)
Canyon Creek (CC287/288)	**194** (cv = 1.72)	**2420** (cv = 1.09)	**5.6** (cv = 0.75)	**292** (cv = 8.89)	**714** (cv = 0.84)
Ninemile Creek (NM305)	**92.1** (cv = 0.802)	**3410** (cv = 0.47)	**1.6** (cv = 0.86)	**13.1** (cv = 2.63)	**276** (cv = 0.92)
Big Creek (BC260)	**28** (max. detected)	6.9 (max. detected)	Not detected to 0.03	1.7 to 91.1 (measured)	0.9 to 4.7 (measured)
Moon Creek (MC262)	3.7 (cv = 1.2)	**121** (cv = 0.39)	0.047 (cv = 2.24)	0.42 (cv = 6.00)	9.9 (cv = 3.06)
Pine Creek (PC305)	4.56 (cv = 1.3)	**112** (cv = 0.45)	**5.4** (cv = 96.4)	**12.3** (cv = 19.9)	**90.2** (cv = 2.93)
South Fork CdA River (Pinehurst) (SF271)	**55.7** (cv = 1.34)	**1,430** (cv = 0.633)	**20.9** (cv = 0.873)	**369** (cv = 5.53)	**2,920** (cv = 0.644)
Coeur d'Alene River					
Coeur d'Alene River (Harrison) (LC60)	**51.6** (cv = 1.08)	**344** (cv = 0.475)	**29** (cv = 1.39)	**1,510** (cv = 4.11)	**4190** (cv = 1.02)
Coeur d'Alene Lake					
Coeur d'Alene Lake (Post Falls) (SR50)	2.12 (cv = 0.865)	**57.6** (cv = 0.476)	NA	156 (cv = 3.86)	3,640 (cv = 3.67)
Spokane River					
Spokane River (Long Lake) (SR85)	1.45 (cv = 0.498)	**27.3** (cv = 1.74)	NA	110 (cv = 0.99)	2210 (cv = 3.12)

[a]Estimated expected value (average discharge) is a calculated value based on a regression line fit to the data while the average annual discharge is based on the period of record and taking an average.

Table 4-1 (Continued)
Summary of Hydrology, Hydrogeology, Mine Production Surface Water Concentrations, and Mass Loading

[b]Estimated expected values for discharge, concentration and mass loading are for the following sampling locations: PR14, NF50, SF228, CC287/288, NM305, BC260, MC262, PC305, SF271, LC60, SR50, and SR85.

Notes:

Information summarized in this table was previously presented in Parts 1 through 6.

cv - coefficient of variation. The coefficient of variation is a measure of the variability (or uncertainty) of an estimated value. The greater the coefficient of variability, the greater the uncertainty of the estimated value.

NA - not available

Bold - Indicates screening level or TMDL exceedances.

cfs - cubic feet per second

µg/L - microgram per liter

lbs/day - pound per day

Table 4.3-1
Preliminary Estimate of Mill Tailings Produced in the Coeur d'Alene Mining District

Disposal Method[a]	Dates	Tailings (ton)	Metals Contained in Tailings (ton)		
			Silver	Lead	Zinc
To creeks	1884-1967	70,000,000	2,400	880,000	>720,000
To dumps	1901-1942	14,600,000	400	220,000	>320,000
Mine backfill	1949-1997	18,000,000	200	39,000	22,000
To impoundments	1928-1997	26,200,000	300	109,000	180,000
Total	1884-1997	120,700,000	3,300	1,248,000	>1,242,000

[a]Long (1998) defines dumps as unsecured stockpiles of tailings. Impoundments are secured by dams or other structures. Many impoundments were built over and from older tailings dumps.

Source: Long (1998)

Table 4.3-2
History of Tailings Disposal Practices in the Coeur d'Alene Basin

Date	Milestone
1886	Processing of ore initiated using jigging.
1891	Six mills operating, with a total capacity of 2,000 tons per day
1901-1904	Construction of plank dams on Canyon Creek near Woodland Park and on the South Fork near Osburn and Pinehurst to control tailings movement. Large volumes of tailings accumulate behind the dams.
1905	Jig tailings from the Morning mill contained about 8% lead and 7% zinc.
1900-1915	Recovery of zinc initiated during this period. Previously, zinc was not recovered, and mills primarily processed low-zinc ores.
1906	Total milling capacity in the basin was 7,000 tons per day
1910	Flotation introduced in the basin at the Morning mill. Increased metals recoveries were achieved using flotation. Flotation tailings were finer grained than jig tailings and were transported greater distances by streams.
1917	Plank dams at Woodland Park and Osburn breached by flood waters.
1918	Flotation had been adopted at most mills by this time.
mid-1920s	Tailings observed in Spokane River.
1925	Flotation tailings from the Morning mill contain <1% each of lead and zinc.
1926-1928	Bunker Hill mills begin placing tailings at Page Pond and the present-day location of the Central Impoundment Area.
1932	Dredging operations initiated in Lower Coeur d'Alene below Cataldo. Dredging continued until 1967. Dredge spoils were placed at Mission Flats.
1933	Plank dam near Pinehurst breached by flood waters.
1940-1942	Addition of 12 new mills with a combined capacity of 2,000 tons per day. Total milling capacity in the basin was 12,000 tons per day.
1940s	Reprocessing of a portion of the tailings that had accumulated behind the Osburn and Woodland Park plank dams.
Late 1950s	Reuse of tailings as stope fill initiated.
1960s	Start of I-90 construction. Tailings from Mission Flats and Bunker Hill tailings pond used in embankment construction.
1968 to present	All tailings impounded or used as stope fill.

Table 4.5-1
Estimated Sediment Loads at the Estimated 10th and 90th Percentile Discharges and Estimated Expected (Average) Discharge

Sampling Location	Discharge (cfs)	Suspended Sand Discharge (tons/day)	Suspended Fines (<63 µm) Discharge (tons/day)	Total Suspended Sediment Discharge (tons/day)	Total Bedload Sediment Discharge (tons/day)
Canyon Creek (Above Mouth Near Wallace)					
10th Percentile	11	0.0249	0.00463	0.0266	0.000273
Estimated Expected Discharge	53	0.402	0.244	1	0.0163
90th Percentile	149	2.51	3.29	6.68	0.240
Ninemile Creek (Above Mouth Near Wallace)					
10th Percentile	3	0.000293	0.0000591	0.000284	0.00000463
Estimated Expected Discharge	19.8	0.0812	0.0445	0.119	0.00984
90th Percentile	41	0.710	0.572	1.22	0.189
South Fork (at Silverton)					
10th Percentile	48	0.00952	0.0966	0.139	0.00623
Estimated Expected Discharge	230	0.841	2.64	4.38	0.29
90th Percentile	649	16.3	23.5	42.9	3.68
Pine Creek (Below Amy Gulch Near Pinehurst)					
10th Percentile	29	0.0000994	0.0000232	0.000113	0.00227
Estimated Expected Discharge	215	0.129	0.0806	0.228	0.772
90th Percentile	387	1.06	0.882	2.13	4.27
South Fork (Near Pinehurst)					
10th Percentile	97	0.0568	0.0489	0.0891	0.0114
Estimated Expected Discharge	533	4.61	4.25	7.60	1.14
90th Percentile	1290	45.1	43.1	76.4	12.3
North Fork (at Enaville)					
10th Percentile	253	0.000771	0.000924	0.00154	0.0000411
Estimated Expected Discharge	1660	0.579	1.15	1.71	0.0954
90th Percentile	5090	29.9	80.6	111	9.65
Coeur d'Alene River (Near Harrison)					
10th Percentile	348	0.000111	0.314	0.112	--
Estimated Expected Discharge	2810	1.00	55.7	35	--
90th Percentile	6870	49.5	511	410	--

Note: cfs - cubic feet per second

5.0 SUMMARY OF FINDINGS

The following sections summarize the findings on the nature of metal contamination in source area soil and sediment, groundwater, and surface water in the basin, as well as transport of metal contamination and sediment via surface water.

5.1 SOURCE TYPES, SOIL, AND SEDIMENT CHARACTERIZATION

Building on the conceptual site model summarized in Section 2, the nature and extent of metals in source areas and impacted soil/sediment in the basin, and their fate and transport, are presented in this section.

5.1.1 Source Characterization

The Bureau of Land Management (BLM) identified approximately 1,080 mining-related source areas in the basin. The number of BLM source areas, number of producing mines, and details on ore and tailings production for each watershed are summarized in Table 4-1. Within these source areas, five different primary source types were identified: mine workings, waste rock, tailings, concentrates and other process wastes, and artificial fill. Secondary sources include affected media (e.g., floodplain deposits) that act as sources of metals to other media or receptors. Of these source types, a limited number of samples were collected and analyzed. Results of these analyses are presented in this section.

Available data for source types were grouped into the following categories for analysis:

- Adit and seep drainage
- Floodplain sediments
- Floodplain tailings
- Floodplain waste rock
- Upland concentrates and process wastes
- Upland waste rock
- Upland tailings

Metals concentrations for the source types sampled and analyzed are summarized in Attachment 1 for each watershed and for the basin as a whole. For each of the ten COPCs, the number of samples analyzed, frequency of detection, the average concentration and the number of results exceeding 1x, 10x, and 100x the screening levels are shown. As shown in Attachment 1, measured concentrations in all source types exceeded the screening levels for at least one of the ten COPCs. To illustrate, pooled metal concentration data from the entire basin were used to calculate the probability that the true average concentration of a metal in a given source type is greater than the applicable screening level. Results for arsenic, cadmium, lead, and zinc for the seven source types evaluated are presented in Part 1, Section 4.2.4 and summarized in Table 5.1.1-1. As shown in Table 5.1.1-1, except for arsenic in adit and seep drainage, for these four metals the probability that the average concentration exceeds screening levels is high, ranging from 45 to 100 percent.

Mass loading data, along with sampling location maps and background reference documents, were used to further evaluate source areas identified by the BLM. Two representative source areas, the Tamarack No. 7 in Canyon Creek and the Rex No. 2 in Ninemile Creek were selected to illustrate the nature and extent of metals in the different source types, and to show the movement of metals from the primary sources to affected media (e.g., soil, sediment, groundwater and surface water). The Tamarack No. 7 source area is adjacent to Canyon Creek and includes an adit, waste rock piles and tailings piles. Soil, sediment, groundwater and surface water samples were collected from this source area. The Rex No. 2 source area is approximately 0.2 mile northwest of Ninemile Creek and includes an adit, a mill, waste rock piles and tailings ponds. Cadmium, lead and zinc concentrations are summarized in Tables 5.1.1-3 through 5.1.1-9. Physical features are shown in Figures 5.1.1-1 and 5.1.1-2.

As shown in Figures 5.1.1-1 and 5.1.1-2, the adits, tailings ponds and waste rock piles are the primary source of metals in the Tamarack No. 7 and Rex No. 2 source areas. Adit, waste rock and tailings metals concentrations were several times greater than screening levels and were significantly higher than metals concentrations at off-site locations. Metals from the waste rock piles and tailings ponds are transported either by groundwater (dissolved phase) or surface water (both particulate and dissolved phase) directly to surface water. Metals from the adits drain via groundwater and surface flow to surface water. Metals from these sources may be deposited in sediments and alluvium in the creek beds (e.g., South Fork impacted floodplain) or transported downstream by surface water flow. Sediment and alluvium metals concentrations reflect both adjacent sources (e.g., Tamarack No. 7) as well as upgradient source areas.

In addition, one representative impacted area, the floodplain of the South Fork near Osburn, Idaho, was selected to illustrate the nature and extent of metals in affected media, and to show the movement of metals through this media to other affected media (e.g., groundwater and surface water). Cadmium, lead and zinc concentrations are summarized in Table 5.1.1-10. Physical features and sampling locations are shown in Figures 5.1.1-3 and 5.1.1-4. Metals concentrations were several times greater than screening levels and were significantly higher than metals concentrations at off-site locations. Metals from the impacted floodplain are transported either by groundwater (dissolved phase) or surface water (both particulate and dissolved phase), where they are transported farther downstream.

A total of 114 adits and 20 seeps with documented drainage were identified during the remedial investigation. Available data are summarized in Table 5.1.1-11. Data presented in Table 5.1.1-11 were summarized from information presented in the Restoration Alternatives Plan (RAP) (Gearheart et al. 1999). Appendix A to the RAP is included as Appendix J to this RI report.

For each adit and seep, average discharge, average total zinc concentration, average total zinc mass loading, and associated source areas, are shown in Table 5.1.1-11. Mass loading was calculated from average concentration and discharge data if more than one sampling result was available. Adits considered major loaders (generally with a loading of more than 10 pounds zinc per day or 1 pound lead per day) include the following:

- Hercules No. 5 (BUR098)
- Tamarack No. 7 (BUR067)
- Gem No. 3 (BUR190)
- Success No. 3 (OSB089)
- Star 1200 Level (MUL012)
- Sidney (MAS081)

The total average zinc load from all adits and seeps is estimated to be about 126 pounds per day.

5.2 GROUNDWATER IMPACTS

During evaluation of contaminant transport in the South Fork, North Fork and their tributaries, bedrock was found to be an important aspect of the physical system. Within the upper portion of the basin (above the confluence of the North and South Forks), bedrock geometry, to a large extent, influences the geometry and the volume of the overlying unconsolidated alluvium. In the South Fork, North Fork and tributaries, water table aquifers (groundwater flowing through the alluvial material) were present. Aquifers identified in each watershed are summarized in Table 4-1.

As observed and studied in Canyon Creek, narrow sections of the canyon, in which bedrock is near or at the surface, limit the volume of alluvium present. Conversely, wider sections of the canyon (where bedrock has been more deeply eroded) allow for the deposition of a larger volume of alluvium. The streams in these areas usually have a wide floodplain. When the volume of alluvium that contains groundwater is reduced it tends to force the groundwater to the surface and act as recharge to the surface water in the creek. When the volume of alluvium increases (wider or deeper floodplain) surface water tends to move downward through the stream bed into the groundwater. The U.S. Geological Survey (Barton 2000) studied the surface water/groundwater interaction in Canyon Creek and in the South Fork. The findings of their work confirm this interaction of surface water/groundwater. This is an important mechanism in the transport of metals between surface water and groundwater. The results of these studies are presented in the individual watershed reports.

Perched groundwater conditions are expected to occur locally in upland portions of the basin where sufficiently thick soil and colluvial material overlie the native low-permeability bedrock. Perched groundwater could be expected to occur most frequently at or near the soil/bedrock interface and likely would be present as a relatively thin, seasonal zone of saturation following periods of snowmelt or heavy precipitation. Perched groundwater is not believed to be regionally significant, but can serve as a source of recharge to the underlying bedrock aquifer system at the local level.

Distinct and generally localized hydrogeologic flow systems also can develop within mine waste areas such as constructed tailings impoundments. Dozens of these mine waste impoundment areas are present within the basin (Gross 1982; Morilla et al. 1975; Dames and Moore 1991), ranging from less than an acre to almost 200 acres in size. Four of the larger flotation tailing impoundments are the Central Impoundment Area (CIA) near Kellogg (approximately 190 acres) and Page Tailings Area near Smelterville (approximately 70 acres), Hecla-Star Tailing Ponds, and ponds associated with the Lucky Friday, Golconda and Sunshine mine/mill facilities.

The majority of these tailings impoundments are present within the South Fork valley and its major tributaries. Groundwater, when present within these impounded mine wastes, shows varying degrees of hydraulic interaction with shallow alluvial aquifer systems that often underlie the impoundment areas. Where the mine waste materials are predominantly finer grained flotation tailings (e.g., Page tailing pile), groundwater mounding can occur. Morilla et al. (1975) found that water levels in the regional alluvial aquifer beneath the tailings pile were not significantly affected by the groundwater mound within the pile due to the large differences in vertical hydraulic conductivity between the tailings and the underlying alluvial material. Other tailing impoundments containing predominantly coarser grained jig tailings may remain unsaturated year-round, or portions of the pile may be seasonally saturated and hydraulically interactive with a shallow alluvial aquifer system.

Similarly, large areas of the valley floors of Canyon Creek, Ninemile Creek, and the South Fork are blanketed with a variable thickness of tailings. The tailings were deposited over broad portions of the valley floodplain during flooding events that caused many tailings impoundment dams (i.e., coffer dams) to fail (Norbeck 1974; Houck and Mink 1994). These coarser grained deposits generally do not support the development of a separate groundwater flow system, but may become seasonally saturated and hydraulically connected with underlying alluvial aquifer systems during periods of high snowmelt and precipitation.

Groundwater was also found to occur in the underlying bedrock. However, the volume of flow is limited and confined to fractures and faults. In much of the upper basin, groundwater moves from bedrock fractures into the alluvial aquifers or discharges from seeps and eventually enters the streams and rivers. Groundwater in bedrock in the upper portion of the basin was not identified as a major pathway for contaminant migration.

Limited data are available on groundwater metal concentrations. Available data for community drinking water systems that draw water from groundwater were reviewed to evaluate potential exceedances of federal drinking water standards (maximum contaminant levels [MCL]). Results are summarized in Table 5.2-1. The frequency of homes showing exceedances of the MCLs is low, with lead and cadmium showing the highest number of exceedances. The following section summarizes the findings from Canyon Creek, where numerous groundwater monitoring wells were installed and sampled for the RI/FS. Detailed groundwater studies have not been conducted in the basin. Additional groundwater data may be collected if needed to support remedial design.

5.2.1 Canyon Creek

The groundwater aquifer in Canyon Creek is expected to be typical of most impacted areas of groundwater in the upper basin. While the South Fork is less of a high energy system than most of its tributaries, groundwater and metal contamination is expected to behave in a similar manner.

Table 5.2-2 is a summary of dissolved zinc concentrations for a 1998 groundwater sampling event conducted as part of the remedial investigation. Zinc was selected to show the distribution of concentrations because it is transported mostly as a dissolved metal and should behave similarly in surface water and groundwater. All the wells (listed in the table from upstream to downstream) were sampled over a period of a few weeks.

As shown in the table, the range of concentrations is highly variable from well to well, and less variable for samples collected from different depths in the same well. At depths up to 10 feet the concentration range between wells is approximately 16 to 40,500 micrograms per liter. The variability in the concentrations between wells continues with depth. A trend of increasing concentrations in groundwater is noted in well samples adjacent to and downstream of the Hecla Star Tailings pile and the Silver Valley Natural Resource Trustees repository (wells below CC453) as a result of the presence of mining waste. This is an area where contaminated floodplain material had been removed and placed in the nearby repository. It is also an area where, based on the USGS seepage study and the estimated expected mass loading data, the stream is losing water to the groundwater. It is difficult to separate out the impacts in this area from source material verses contamination entering the groundwater from upgradient surface water.

Based on the data in Canyon Creek, groundwater is substantially impacted. Metal contamination is expected to be highly variable and depend on both the aquifer properties and losing/gaining nature of stream reaches. Based on stream channel morphology, the high degree of variability observed in Canyon Creek is expected to occur throughout most of the tributaries and South Fork. This will make it difficult to predict the levels of contamination moving in the groundwater system at different times of the hydrologic cycle.

5.3 SURFACE WATER

The movement of metals and sediment from upland and floodplain source areas to streams and rivers of the basin are summarized in this section. A probabilistic model was used to estimate average surface water discharge, metals concentrations, and metals mass loading in the South Fork, North Fork, Main Stem Coeur d'Alene River, Spokane River, and important tributaries. Available sediment data were used to evaluate transport of fine-grained and bedload sediment within the basin. Surface water and sediment within Coeur d'Alene Lake were independently evaluated using mass balance and benthic flux measurements and calculations.

5.3.1 Probabilistic Model Description

Understanding the movement, or fate and transport, of metals from source areas to other parts of the basin is a key piece of both the remedial investigation (RI) and the feasibility study (FS). To understand a large natural system like the Coeur d'Alene River Basin, it is important to answer the what, where, and how questions of metal movement.

What is the best way to describe metal movement and deal with the large variation in the natural world and the data? A mathematical model, called a *probabilistic model*, was selected as the best tool to handle the complex issues involved. For selected stream monitoring points in the basin (e.g., the mouth of Canyon Creek, Pinehurst, and Harrison), the model is used to:

- Predict metal concentrations in the stream
- Predict metal loading in the stream (i.e., how much metal is flowing in the stream)
- Quantify the uncertainty associated with the predictions in a consistent and coherent manner

The portion of the model used for the RI is limited to current conditions in the basin. In the FS, the complete model is used to make quantitative estimates of the potential remedial performance associated with each remedial alternative. Because it helps quantify the degree of certainty that a remedial action will actually result in meeting cleanup goals, the model can be used in the remedy selection process to help decision-makers select and prioritize cleanup efforts. The modeling methodology is summarized in Part 1, Section 5.4.2, and presented in detail in a separate technical memorandum (URSG 2001).

5.3.2 Discharge

Estimated expected values were calculated for 41 sampling locations, beginning at the most upgradient location in the Upper South Fork (SF220 below Mullan) to the most downgradient location on the Spokane River (SR85 above Lake Roosevelt). These results are presented in detail in Parts 2 through 6. For this discussion, results for thirteen sampling locations were selected to summarize discharge, metals concentrations and mass loading in the South Fork, North Fork, and their tributaries, as well as the Main Stem, Lower Coeur d'Alene River, Coeur d'Alene Lake, and the Spokane River. Results for these thirteen sampling locations are summarized in Table 4-1.

As anticipated, the estimated expected value of the discharge generally increases as one progresses from the upper watersheds to the South Fork. The estimated expected value of the discharge approximately doubles between sampling locations SF228 below Trowbridge Gulch in the Upper South Fork (114.6 cfs) and SF239 at Silverton (230 cfs). Canyon (53.4 cfs) and Ninemile Creeks (19.8 cfs) enter the South Fork in this reach and account for a significant portion (65 percent) of this expected increase in discharge.

A reach is defined as the distance between any two adjacent sampling locations. Reaches may be either gaining or losing. Losing reaches occur where the gradient lessens, the valley widens into alluvial floodplains, and surface water discharges to groundwater. Losing reaches were identified in Woodland Park in Canyon Creek and between Silverton (SF239) and Osburn (SF249) on the South Fork.

Gaining reaches occur where the valley narrows and groundwater discharges to surface water or where tributaries discharge to main channels. Gaining reaches were identified where the canyon begins to narrow between SF259 above the confluence with Big Creek (279.6 cfs) and SF268 near Elizabeth Park (345 cfs). Estimated expected discharges continue to increase as one progresses downstream through the Bunker Hill Superfund site. Between SF271 at Pinehurst and LC60 at Harrison, the expected estimated discharge increases by approximately 2,300 cfs. The North Fork, with an expected discharge of 1,660 cfs, enters the South Fork in this reach and can account for the majority of this increase. Based on estimated expected discharge values at sampling locations found at Cataldo (LC50), Rose Lake (LC55), and upstream from Harrison (LC60), the discharge in the Main Stem Coeur d'Alene River remains relatively constant. Any groundwater interactions occurring along the Coeur d'Alene River between Cataldo and Harrison apparently have little net effect on discharge.

Data indicate that more water exits Coeur d'Alene Lake than enters it from the Coeur d'Alene River at Harrison. The estimated expected discharge at Post Falls Dam (SR50) (7,530 cfs) is approximately 4,720 cfs larger than the expected discharge into the Lake from the Coeur d'Alene River (LC60) (2,810 cfs). This difference is likely accounted for by the additional discharges to Coeur d'Alene Lake from other rivers including St. Joe River, St. Maries River, Wolf Lodge Creek, Carlin Creek, Plummer Creek, and Fighting Creek. However, the estimated expected discharges in the Spokane River are less certain because fewer samples were collected along the Spokane River than along the South Fork and the Coeur d'Alene River. In addition to the limited number of data points, the Post Falls Dam affects the water-surface elevation and discharge from the lake to the Spokane River. Discharge increases along the Spokane River from SR50 at Post Falls (7,530 cfs) to SR85 at Long Lake (8,120 cfs), due most likely to contributions from tributaries.

5.3.3 Concentrations

Estimated expected values for dissolved cadmium, total lead, and dissolved zinc concentrations for selected sampling locations are summarized in Table 4-1. Surface water metals concentrations were compared to screening levels to identify locations impacted by mining activities. Screening level exceedances for the thirteen selected locations are summarized in Table 4-1.

Beginning at the sampling location (SF228) below Trowbridge Gulch, dissolved cadmium concentrations exceed screening levels and continue to do so throughout the South Fork and Lower Coeur d'Alene River to Harrison. Dissolved cadmium concentrations also exceed screening levels in Beaver Creek, Canyon Creek, Ninemile Creek, and Big Creek. Dissolved cadmium concentrations were low in Coeur d'Alene Lake and the Spokane River.

Beginning at the sampling location (SF239) at Silverton, total lead concentrations exceed screening levels and continue to do so throughout the South Fork and Lower Coeur d'Alene River. Total lead concentrations in Canyon Creek and Ninemile Creek also exceed screening levels. Increases in estimated total lead concentrations may result from increased discharges and increased suspended sediment loads to which the lead is adsorbed. Total lead concentrations increase between Elizabeth Park and Pinehurst as the South Fork moves through the Bunker Hill Superfund site. Estimated expected total lead concentrations increase approximately 75 percent (from 32 to 56 µg/L). Total lead concentrations in the South Fork decrease significantly (between 60 and 70 percent) after the North Fork converges with the South Fork but are still greater than screening levels throughout the Lower Coeur d'Alene River. Estimated expected total lead concentrations are less than screening levels in the Spokane River; however, seasonal exceedances of water quality criteria are observed (Ecology 1998).

Beginning at the sampling location (SF228) below Trowbridge Gulch, dissolved zinc concentrations exceed screening levels and continue to do so throughout the South Fork and through the basin to the Spokane River at Long Lake. With few exceptions, estimated dissolved zinc (and cadmium) concentrations generally increase in the downstream direction in the South Fork and Lower Coeur d'Alene River. The estimated expected dissolved zinc concentration increases almost 50 percent (from approximately 980 to 1,430 µg/L) between Elizabeth Park (SF268) and Pinehurst (SF271) as the South Fork flows through the Bunker Hill Superfund Site. Dissolved cadmium concentrations increase over 30 percent (from 6.8 to 9.1 µg/L) in this same reach. Estimated expected values of dissolved zinc (and cadmium) concentrations decrease at locations where tributaries, like the North Fork, with low concentrations and high discharges flow into the South Fork and dilute the cadmium and zinc concentrations.

5.3.4 Concentration Versus Discharge

Dissolved metal concentrations typically decrease with increased discharge as dilution occurs. In contrast to dissolved metal concentrations, total metal concentrations generally increase with increasing discharge because increased discharge results in increased sediment concentrations to which some metals (e.g., lead) adsorb.

To illustrate the range of concentrations associated with low-flow and high-flow events, estimated expected metal concentrations at the 10th and 90th percentile discharges are listed in Table 5.3.4-1. Dissolved cadmium and zinc and total lead concentrations are presented because the majority of the cadmium and zinc in surface waters is found in the dissolved form while the majority of the lead is associated with particulates. The 10th percentile was used to represent a low-flow event that might occur in the summer months while a 90th percentile discharge represents a high-flow event that is more likely coincident with spring snowmelt and runoff. As presented in Table 5.3.4-1, dissolved cadmium and zinc concentrations decrease as the discharge increases from the 10th percentile discharge to the 90th percentile discharge. Estimated expected values of total lead concentrations show the opposite trend with concentrations most often increasing with increasing discharge. Estimated expected metal concentrations at the 10th and 90th percentile discharges were also compared with screening levels. Screening level exceedances are summarized in Table 4-1.

5.3.5 Mass Loading

Estimated expected values for dissolved cadmium, total lead, and dissolved zinc mass loading for selected sampling locations are summarized in Table 4-1. All 42 sampling locations evaluated by probabilistic modeling are shown in Figure 5.3.5-1. Mass loading results are shown in Figures 5.3.5-2 through 5.3.5-10. The estimated expected values are compared to the 90th percentile total maximum daily loads (TMDLs) at locations for which TMDLs are available (USEPA 2000). The 90th percentile TMDL values for dissolved cadmium and zinc are exceeded at all locations except at the mouth of the North Fork. Estimated total lead loads exceed the calculated TMDLs by more than an order of magnitude at all locations for which TMDLs were developed. TMDL exceedances are summarized in Table 5.3.5-1. TMDLs for mass loading have not been developed for the Spokane River. (TMDLs for the Spokane River are the ambient water quality criteria adjusted for site-specific hardness.)

As shown in Table 4-1, the dissolved zinc and cadmium and total lead loads increase by nearly an order of magnitude between Trowbridge Gulch (SF228) and the sampling location (SF239) at Silverton. Ninemile Creek and Canyon Creek enter the South Fork in this reach and account for the majority of this increase. Estimated dissolved zinc and cadmium loads decrease between Silverton and Osburn because of decreases in discharges, and total lead loads decrease because of decreases in concentrations.

Expected total lead loads increase dramatically in the BHSS [between Elizabeth Park (SF268) and Pinehurst (SF271)]. Based on the expected values presented in Figures 5.3.5-2, 5.3.5-5, and 5.3.5-8, the BHSS contributes between approximately 50 and 70 percent of the dissolved zinc and cadmium and total lead loads measured in the South Fork at Pinehurst. The BHSS is estimated to contribute between approximately 40 and 50 percent of the dissolved cadmium and zinc loads, but only between approximately 10 and 20 percent of the total lead load measured at Harrison.

The expected lead load between Cataldo and Harrison approximately doubles from 700 pounds/day at Cataldo to 1,500 pounds/day at Harrison. The expected discharges are relatively constant in this same reach. The dissolved cadmium and zinc loads increase by a smaller percentage between Cataldo and Harrison, going from approximately 27 to 29 pounds cadmium/day and from approximately 3,200 to 4,200 pounds zinc/day.

Of the tributaries, Canyon Creek exhibited the largest expected dissolved zinc (714.3 pounds/day) and cadmium (5.6 pounds/day) loads. Because the estimated discharge of the North Fork (approximately 1,600 cfs) is over 30 times the discharge in Canyon Creek, the total lead load of the North Fork is approximately double that of Canyon Creek even though the North Fork's concentrations are significantly lower than those measured at the mouth of Canyon Creek.

To summarize: the largest dissolved zinc and cadmium loading takes place in the BHSS and the largest increases in the total lead load occur in the Lower Coeur d'Alene River.

5.3.6 Dissolved Versus Total Concentration

To illustrate which metals tend to be in the dissolved phase or the particulate (total) phase, the estimated percentages of dissolved cadmium, lead and zinc were calculated for locations throughout the Coeur d'Alene basin. Results were calculated using the MIT diffuse-layer model. Calculation methods are presented in Part 1, Section 5.4.1.5. Results are listed in Table 5.3.6-1.

Cadmium and zinc transport occurs predominantly in the dissolved phase. Dissolved cadmium and zinc concentrations typically constitute 80 to 100 percent of the total metal concentration.

Lead exhibits the opposite trend. Except for measured lead concentrations at the mouths of two tributaries, Ninemile Creek and Pine Creek, the estimated dissolved lead concentration constitutes less than 30 percent of the total lead concentration and, in several instances, is less than 10 percent of the total lead concentration.

5.3.7 Sediment

In general, the suspended and bedload sediment loads increase with increasing discharge. Tributary streams of the South Fork tend to have higher gradients as compared to sites on the South Fork, Main Stem, and the Lower Coeur d'Alene River. Higher gradients indicate a more dramatic response in transport of suspended sediment to changes in stream discharge. Lower stream gradients and velocities indicate a less reactive response to changes in stream discharge. Sediment particles of different size classes begin to be mobilized and transported by stream flow at different thresholds of discharge rates.

Based on a limited number of data points (four), Clark and Woods (2000) estimated the threshold of the fine bedload in Canyon Creek as approximately 170 cfs and the coarse bedload threshold to be approximately 200 cfs. The site selected was 2.8 miles upstream of the confluence of Canyon Creek and the South Fork. The fine materials were defined as being less than 8 mm in diameter and the coarse materials as greater than 8 mm in diameter.

A similar threshold analysis was performed in Canyon Creek at the same location for suspended sediments (McBain and Trush 2000). For suspended sediments, the data were divided into the sand fraction (> 0.0625 mm) and fine material (< 0.0625 mm). Evaluation of the data indicated that fine sediment transport begins from 100 to 170 cfs, with larger inflections in transport occurring between 200 and 300 cfs.

Threshold values were also estimated by McBain and Trush for Pine Creek. The estimated threshold value for transport of sand-sized (> 0.0625 mm) suspended sediments was 200 to 275 cfs.

Ninemile Creek transports significantly more suspended sediment per unit discharge than does Canyon Creek. For example, at a discharge of 53 cfs Canyon Creek transports an estimated 0.75 ton/day. In contrast, at a discharge of only 44 cfs Ninemile Creek transports an estimated 1.53 tons/day of suspended sediment.

Similarly, the South Fork at Silverton transports significantly more suspended sediment per unit discharge as compared to the downstream site at Pinehurst. This probably occurs because of the intervening inflow from Pine Creek, which dilutes suspended sediment concentrations in the South Fork at Pinehurst. There is also a large decrease in suspended sediment transport per unit discharge between Pinehurst and the Coeur d'Alene River at Rose Lake and Harrison. This results from inflow of the North Fork and deposition of sediment in the Coeur d'Alene River upstream of Rose Lake and Harrison.

For most locations, there is not a large difference in the transport characteristics of fine- and sand-sized material. At Rose Lake and Harrison, when stream discharge is less than 10,000 cfs most of the suspended sediment discharge is composed of fine-grained material. For example, at a discharge of approximately 6,300 cfs at Harrison, the estimated discharge of fines is 417 tons/day while the estimated discharge of sand-sized particles is only approximately 35 tons/day. Harrison and Rose Lake are characterized by relatively slow water velocities that appear to be insufficient to transport sand-sized sediment at lower stream discharges. Not until stream discharge exceeds 10,000 cfs does the discharge of sand-sized material at Rose Lake and Harrison approximate the discharge of fine-grained material.

Unlike suspended sediment transport, transport of bed material is not always evident. When bedload discharge does occur, it is often extremely variable both spatially within the stream channel and temporally during steady stream-discharge conditions. The particle-size distribution of bedload sediment samples is proportionately coarser as stream discharge increases.

5.3.8 Coeur d'Alene Lake

The analysis of fate and transport of metals within Coeur d'Alene Lake focused on the following three central questions. One, what happens to metals and nutrients after they enter the lake? Two, what is the role of the lakebed sediments in regulation of metal and nutrient concentrations in the lake's water column? Three, what determines the amount of metals and nutrients discharged from the lake into the Spokane River? The answers to those three questions were developed by integrating a large amount of hydrologic and water-quality data and information in order to examine the interaction of physical, chemical, and biological processes as they relate to the fate and transport of metals and nutrients in Coeur d'Alene Lake.

Once metals and nutrients enter the lake, either in a dissolved or particulate fraction, their fate and transport is highly dependent upon the lake's hydrodynamic characteristics. The lake's short hydraulic-residence time (about one-half year on average), coupled with a propensity for routing riverine inflows as overflow, facilitates advective transport of particulate and dissolved constituents within the lake. During periods of spring snowmelt runoff and winter rain-on-snow events, portions of the overflow plumes are routed through the lake and discharged into the Spokane River within a few days. Conversely, riverine inflows delivered in the late fall and early winter were often routed as underflows into the lake's hypolimnion. During periods of convective or discharge-induced water column mixing, constituents stored in the hypolimnion were circulated throughout the lake's water column.

Mass-balance calculations, using dissolved and particulate loads from riverine and benthic sources, suggest that about 50 percent of the dissolved zinc, inorganic nitrogen, and orthophosphorus that entered the lake was transformed to the particulate fraction. For dissolved cadmium, about 75 percent was transformed; about 90 percent of dissolved lead was transformed to particulate lead. For metals associated with the particulate fraction, about 90 percent were sedimented within the lake. Therefore, geochemical transformation of dissolved (including colloidal) constituents into the particulate fraction was an important process by which sedimentation of metals was augmented; this was in addition to those metal loads initially delivered to the lake in the particulate fraction. Biological processes also affected fate and transport of metals and nutrients. Phytoplanktonic assimilation of dissolved inorganic nitrogen and orthophosphorus converted those constituents into new particulate organic matter; that is, new phytoplankton. Such conversions were not necessarily unidirectional; subsequent death and lysis of phytoplankton transformed particulates back to the dissolved fraction. Phytoplankton also affected dissolved metals via adsorption of dissolved cadmium and zinc; this process was well-illustrated by summertime declines in euphotic zone concentrations of dissolved zinc in Coeur d'Alene Lake. The net result of physical, chemical, and biological processes within the lake was to retain the following approximate percentages of its riverine and benthic input loads (dissolved plus particulate): cadmium, 50 percent; lead, 90 percent; zinc, 35 percent; nitrogen, 5 percent; and phosphorus, 30 percent.

The lakebed sediments played a role in the regulation of metal and nutrient concentrations within the lake's water column. The lake's substantial depth, routing of inflow plumes primarily as overflow, and sedimentation characteristics indicated that scouring of the lakebed sediments was an insignificant source for delivery of particulate and dissolved constituents back into the water column. Therefore, the lakebed sediments served as a major repository for metals and nutrients that had been removed from the water column via sedimentation. However, geochemical processes within the lakebed sediments and near the sediment-water interface facilitated releases of previously deposited metals and nutrients back into the lake's water column. On the basis of benthic-flux measurements made in August 1999, fluxes of dissolved cadmium, zinc, inorganic nitrogen, and orthophosphorus from the lakebed sediments were of similar magnitude to those delivered to the lake by the Coeur d'Alene and St. Joe Rivers. However, the contribution of these benthic fluxes to the lake's water column was muted by adsorption and sedimentation within the lower hypolimnion at or near the sediment-water interface.

The mass balance of metals and nutrients in the lake was used to evaluate the relative contribution of riverine and benthic-flux loads on water-column concentrations. When calculated with annual loads the mass balances indicated that, except for dissolved inorganic nitrogen, the riverine loads of cadmium, lead, zinc, and orthophosphorus were in excess of those discharged from the lake; therefore, one could conclude that benthic fluxes were not needed to account for water-column concentrations. When the mass balances were calculated with monthly loads it was apparent that output loads exceeded input loads during parts of the year for dissolved zinc and inorganic nitrogen; thereby indicative of the potential for benthic fluxes to affect water-column concentrations of these two constituents. However, another geochemical process could also explain why output loads exceeded input loads during part of the year. If riverine-derived particulate matter was remineralized as it was delivered to the hypolimnion via sedimentation, then this transformed source of dissolved zinc and inorganic nitrogen could account for all, or part, of the excess output load. Given the established presence of a positive benthic flux, the internally generated supply of dissolved zinc and inorganic nitrogen is probably a combination of benthic flux and remineralization of riverine-derived loads.

The amount of metals and nutrients discharged from Coeur d'Alene Lake into the Spokane River is determined by the cumulative effect of in-lake physical, chemical, and biological processes acting on metals and nutrients delivered to the lake from riverine and benthic sources. One of the most important processes is sedimentation; either of particulate-bound metals and nutrients delivered by riverine inputs, or of particulate constituents formed by geochemical and biological transformations of dissolved constituents delivered either by riverine or benthic sources. The overall effect of sedimentation is to increase the ratio of dissolved to particulate constituents between their entry into the lake and their discharge from it. On a yearly basis, the majority of cadmium and zinc input to the Spokane River was in the dissolved fraction, whereas only about 15 percent of the lead was dissolved.

Annual discharge volume was another important influence on the amount of metals and nutrients discharged to the Spokane River from Coeur d'Alene Lake. Both dissolved and particulate loads had strong, positive correlations with discharge. Within a particular year, the temporal variation of discharge volume and the in-lake routing of inflows played an important role in determination of the amount of metals and nutrients discharged to the Spokane River. The predominance of overflow, especially, during periods of elevated inflow discharges, increased the frequency at which riverine loads of metals and nutrients could traverse the lake for delivery to the Spokane River. Alternatively, late autumn and winter inflows were usually routed as underflows into the hypolimnion. Underflows affected the hypolimnion in two important ways. Under low discharge conditions, hypolimnetic concentrations could be enriched as additional metals and nutrients were routed deep into the lake. Under elevated discharge conditions, the underflows could displace hypolimnetic water with its associated metal and nutrient loads and result in discharge out of the lake.

A large amount of hydrologic and water-quality data and information from numerous sources was employed in the foregoing evaluation of the fate and transport of metals and nutrients in Coeur d'Alene Lake. Obviously, a myriad of physical, chemical, and biological processes are in operation over a wide range of temporal and spatial scales. Given this complexity, no one process can be identified as being the "master variable" in control of the lake's metal and nutrient geochemistry. However, over a multiple-year time scale, the hydrological (physical) effects on the quantities of metals and nutrients delivered to and routed within the lake are very important determinants of the lake's existing water-column and lakebed-sediment geochemistry. The influence of chemical and biological processes also occur over a multiple-year time scale, but may be more easily detected within the context of seasonal changes within one year. Coeur d'Alene Lake is also spatially complex because of its long and narrow axis, well-indented shoreline, and wide range in depth. Such spatial variability affects the relative influence of physical, chemical, and biological processes among different locations within the lake.

Although considerable information has been gathered on the fate and transport of metals and nutrients in Coeur d'Alene Lake, several important issues remain unclear; most notably, the relative role of riverine and benthic sources in the determination of water-column concentrations and the export of metals and nutrients to the Spokane River. Inexorably tied to this is the spatial and temporal effects of transformation and remineralization reactions on dissolved and particulate metals and nutrients within the water column and at the water-sediment interface.

5.3.9 Spokane River

Metals discharged from Coeur d'Alene Lake in dissolved and particulate form are carried down the Spokane River. The Spokane River regularly exceeds water quality criteria for zinc. Criteria for lead and cadmium are also frequently exceeded, especially at higher flows (Ecology 1998). Fine-grained sediment in the Spokane River is contaminated with lead and zinc, with generally decreasing concentrations from upstream to downstream. Sediment screening levels are exceeded in several locations where fine-grained sediment accumulates, most notably in segment SpokaneRSeg02 upstream of the City of Spokane, and behind dams and in reservoir sediments in segment SpokaneRSeg03.

Concentrations of dissolved zinc exceed ambient water quality criteria through most of the year in the upper portions of the river and exceed ambient water quality criteria in lower portions of the river during high flows associated with snowmelt events and spring runoff. Concentrations of dissolved cadmium, lead, and zinc typically exceed the ambient water quality criteria during high flows. Fine-grained sediment in depositional areas, including natural shoreline beach and bar deposits (places used for water-contact recreation), show elevated concentrations of lead.

The main depositional areas are behind Upriver Dam, behind the low dam at Spokane Falls in Spokane, the Upper Falls hydropower facility in Spokane at Riverfront Park, and behind Ninemile Dam downstream from Spokane. Pockets of fine-grained sediments are located behind boulders and on small beaches throughout the segment. The backwater areas behind the dams contain small amounts of habitats such as riparian wetlands, that are otherwise not common along the Spokane River. Hangman Creek enters the Spokane River just west of downtown Spokane. The flow and water dilution contributed by Hangman Creek is typically small, but substantial amounts of clean Palouse-derived sediment (with low metals concentrations) are discharged during high spring flows.

Concentrations of metals in the sediment of Long Lake are slightly elevated. Concentrations of metals in sediments in the upper part of the Spokane Arm of Lake Roosevelt are slightly elevated (mainly zinc).

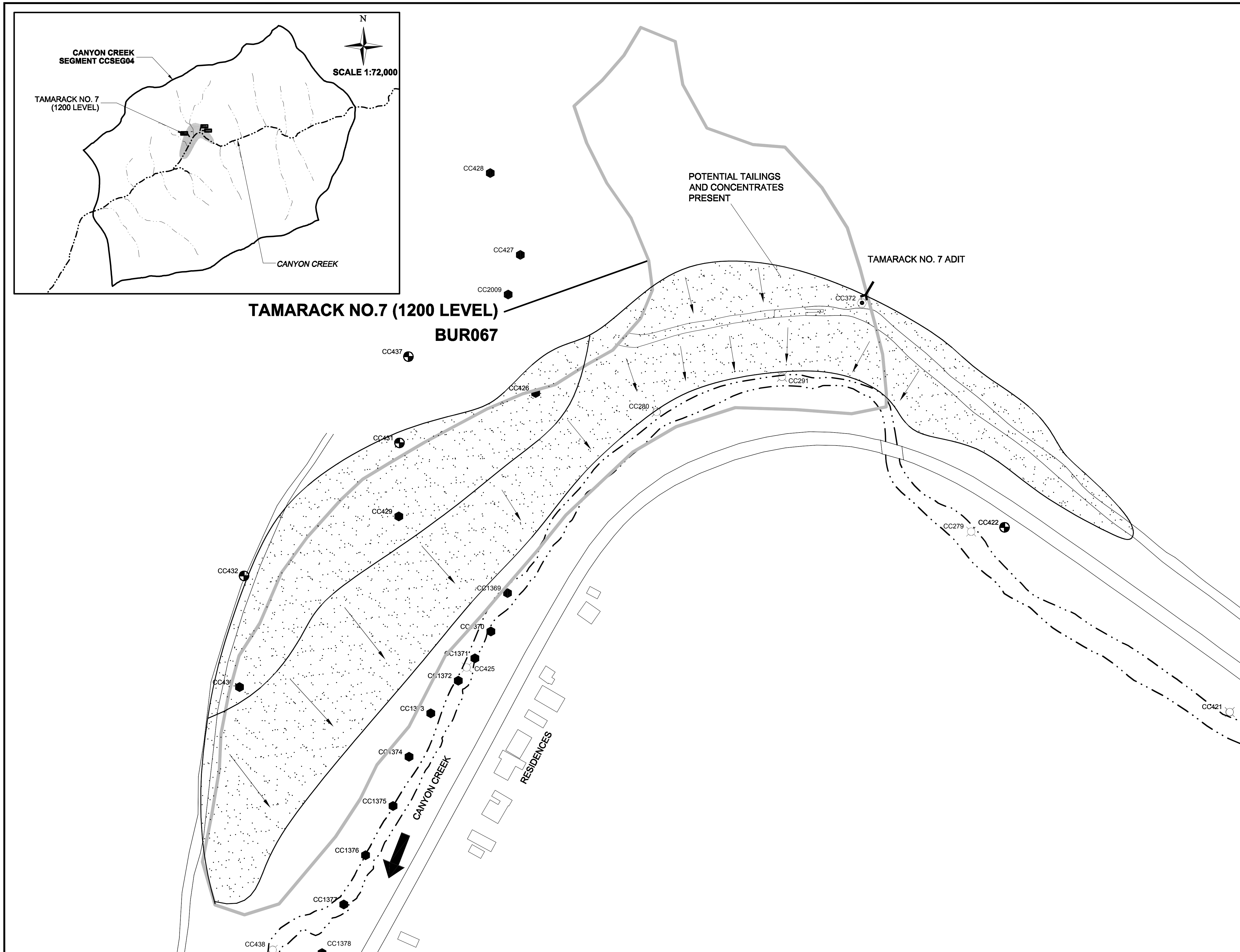
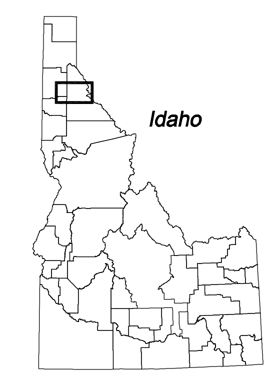


Figure 5.1.1-1
Tamarack No. 7 (1200 Level) Site Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Adit Surface Water Sample
- Monitoring Well Groundwater Sample
- River Surface Water Sample
- Surface/Near Surface Soil Sample
- BLM Source Area



Location Map

SCALE 1:1,800

0 75 150 Feet

N

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Coeur d'Alene Basin RI/FS
RI REPORT

EPA
REGION 10

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Date: 07/31/01

This Map is based on Idaho
State Plane Coordinates West Zone,
North Americaon Datum 1983

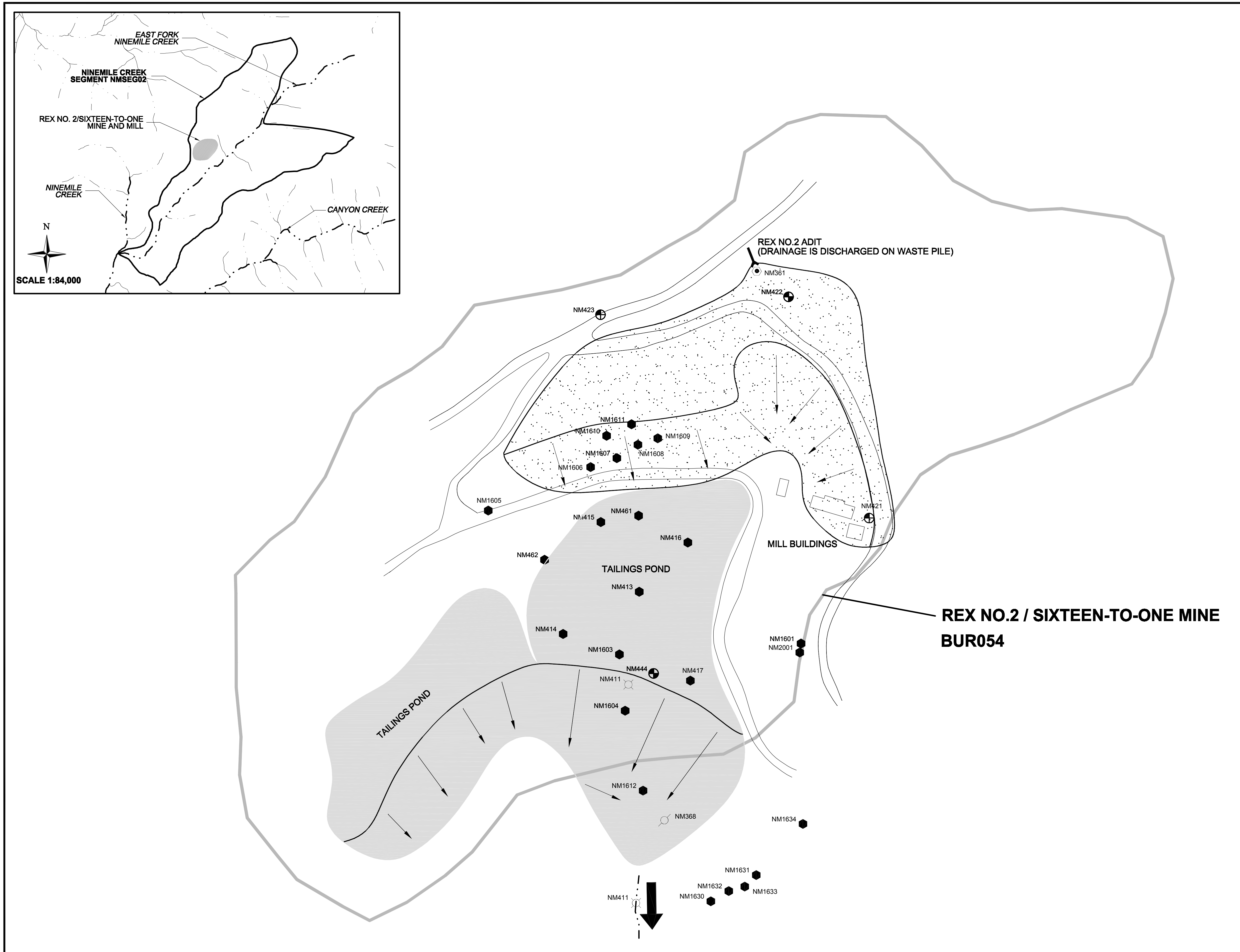
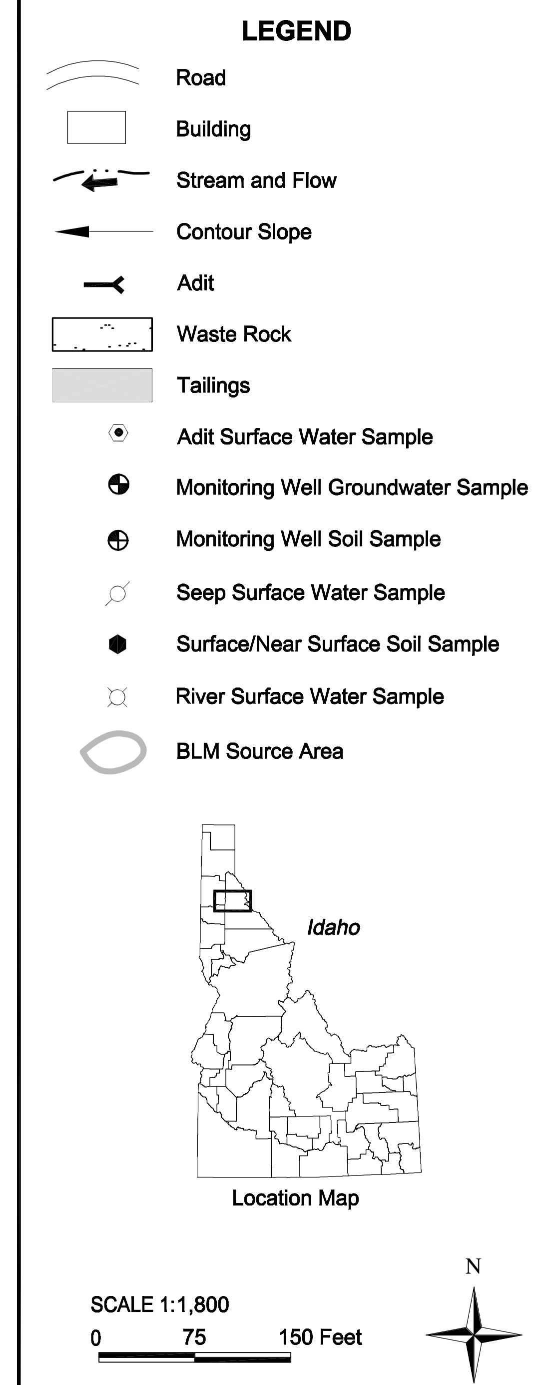


Figure 5.1.1-2
Rex No. 2/Sixteen-To-One Mine and Millsite Map, BLM Source Areas and Sampling Locations



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Coeur d'Alene Basin RI/FS
RI REPORT

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Date: 08/17/01

This Map is based on Idaho State Plane Coordinates West Zone, North Americaon Datum 1983

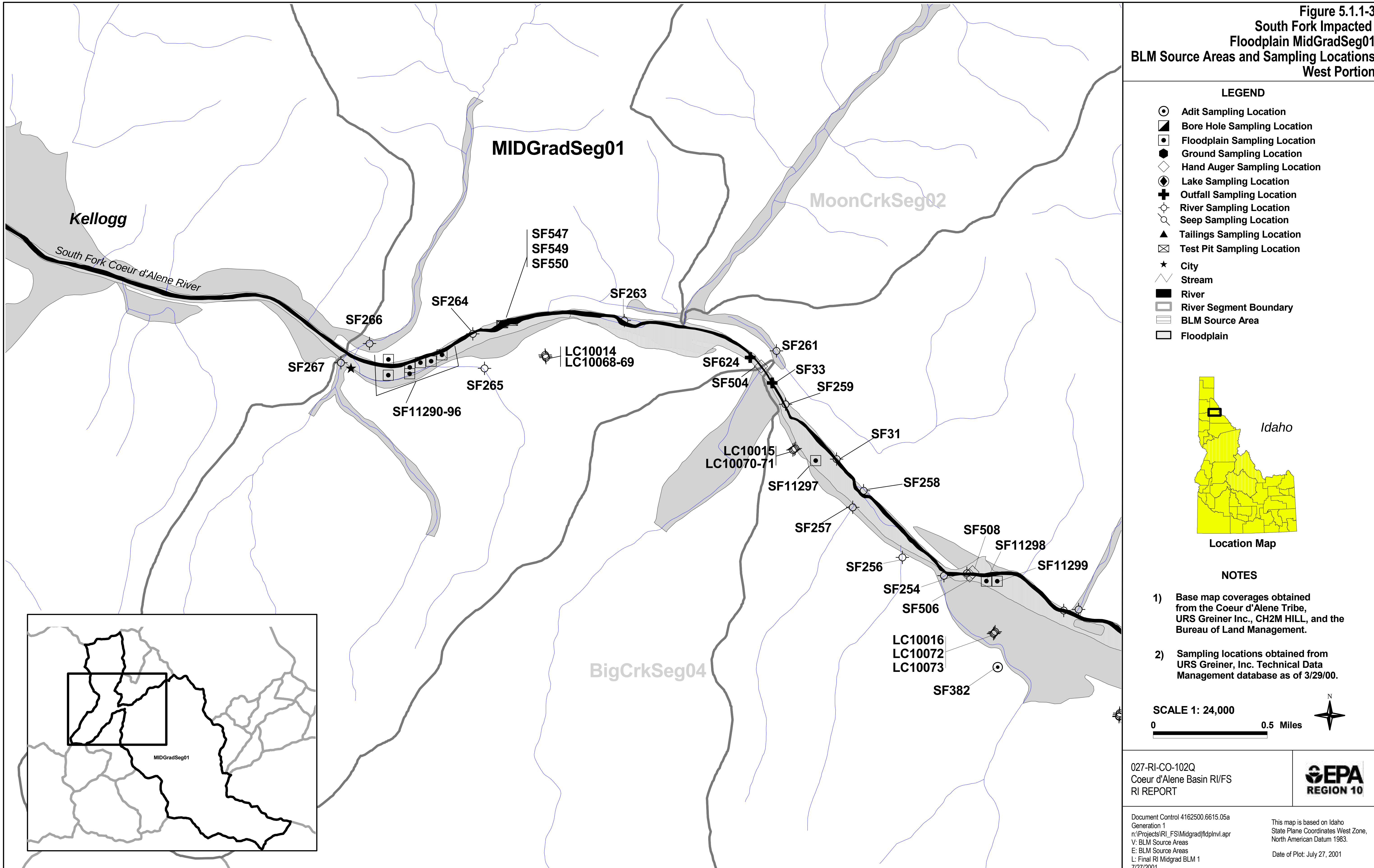
Figure 5.1.1-3
South Fork Impacted
Floodplain MidGradSeg01
BLM Source Areas and Sampling Locations
West Portion
LEGEND
Adit Sampling Location
Bore Hole Sampling Location
Floodplain Sampling Location
Ground Sampling Location
Hand Auger Sampling Location
Lake Sampling Location
Outfall Sampling Location
River Sampling Location
Seep Sampling Location
Tailings Sampling Location
Test Pit Sampling Location
City
Stream
River
River Segment Boundary
BLM Source Area
Floodplain
Idaho
Location Map
NOTES
1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.
2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.
SCALE 1: 24,000
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0.5 Miles
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Coeur d'Alene Basin RI/FS
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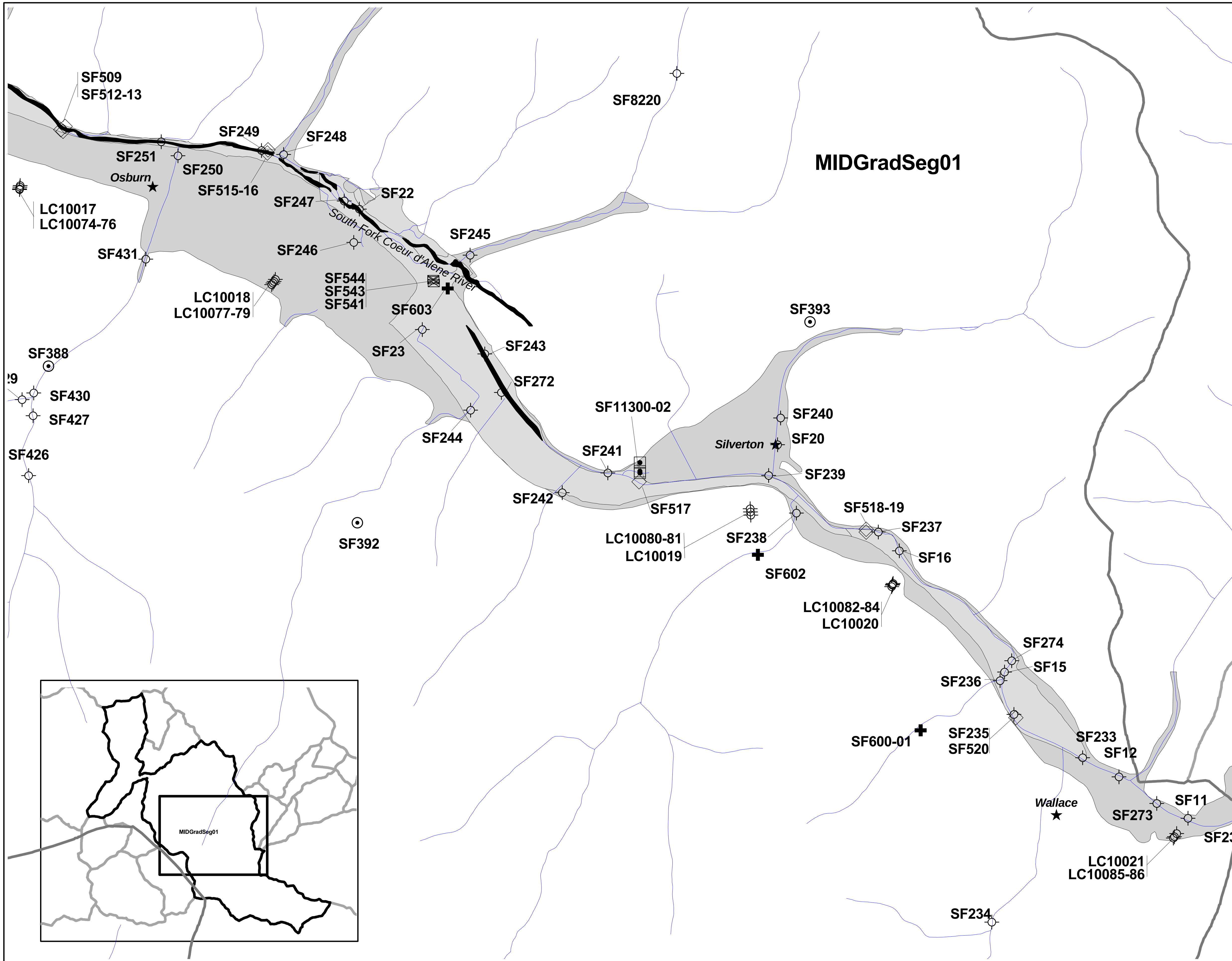
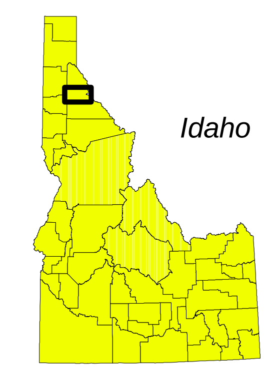
V: BLM Source Areas
E: BLM Source Areas
L: Final RI Midgrad BLM 1
7/27/2001
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.
Date of Plot: July 27, 2001
MIDGradSeg01
Kellogg
South Fork Coeur d'Alene River
MoonCrkSeg02
BigCrkSeg04
SF547
SF549
SF550
SF263
SF264
SF266
SF267
SF265
SF11290-96
LC10014
LC10068-69
SF624
SF504
SF261
SF33
SF259
SF31
LC10015
LC10070-71
SF11297
SF258
SF257
SF256
SF508
SF11298
SF11299
SF254
SF506
LC10016
LC10072
LC10073
SF382
MIDGradSeg01

Figure 5.1.1-4
South Fork Impacted Floodplain MidGradSeg01 BLM Source Areas and Sampling Locations East Portion



LEGEND

- Adit Sampling Location
- Bore Hole Sampling Location
- Floodplain Sampling Location
- Ground Sampling Location
- Hand Auger Sampling Location
- Lake Sampling Location
- Outfall Sampling Location
- River Sampling Location
- Seep Sampling Location
- Tailings Sampling Location
- Test Pit Sampling Location
- City
- Stream
- River
- River Segment Boundary
- BLM Source Area
- Floodplain



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

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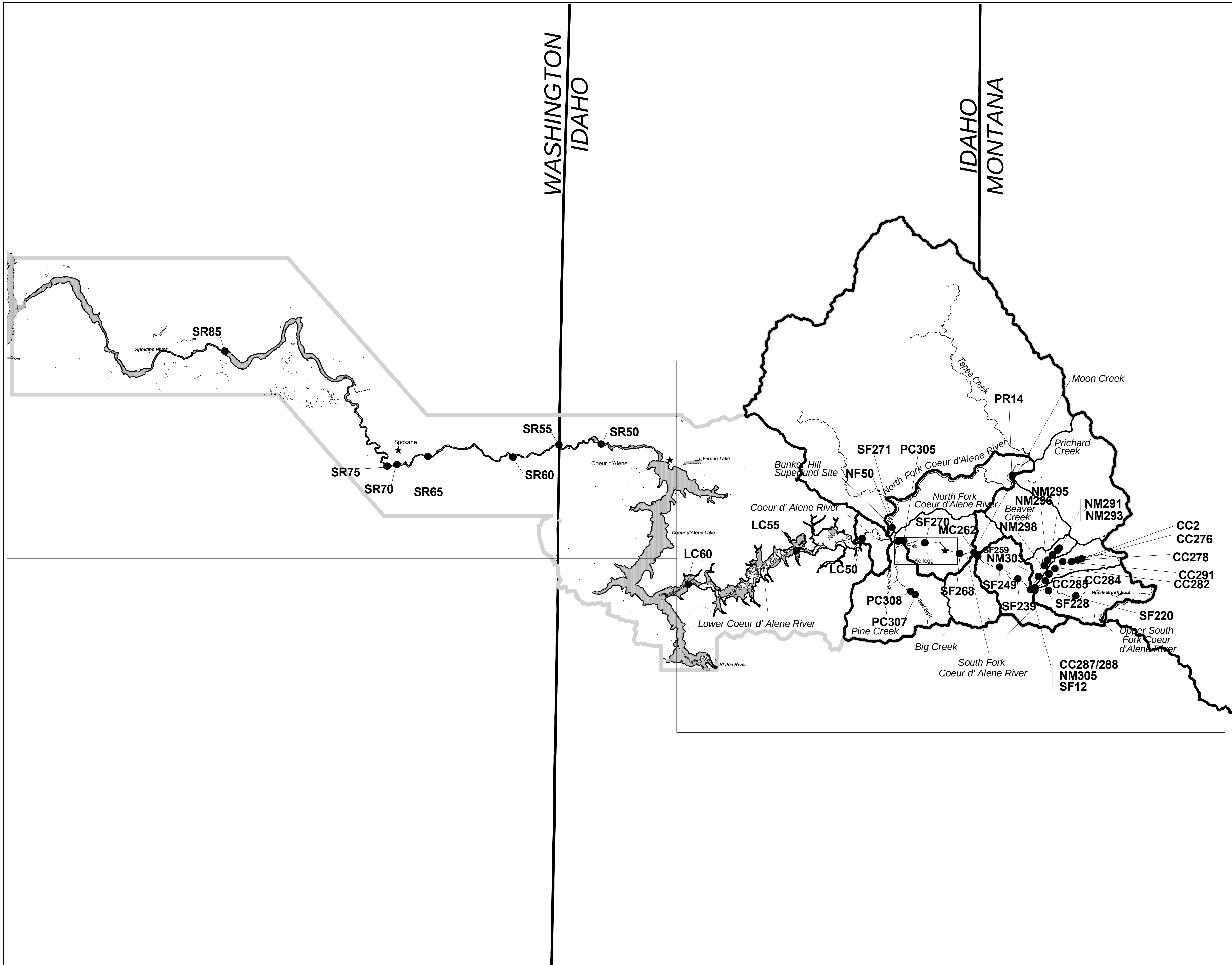
L: Final RI BLM Midgrad2
8/17/2001

This Map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

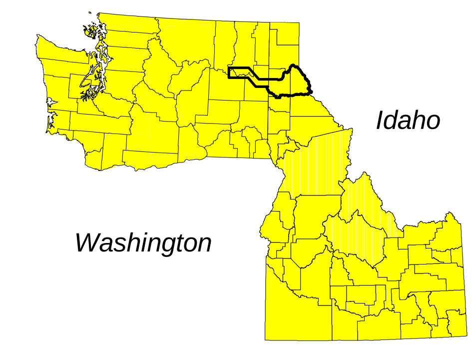
Date of Plot: August 17, 2001

Figure 5.3.5-1
Sampling Locations Evaluated in Probabilistic Modelling



LEGEND

- ● Sampling Locations
- ★ Cities
- Lakes and Rivers
- Watershed Boundaries
- Bunker Hill Superfund Site
- Project Boundary



Location Map

NOTES

1) **Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.**

SCALE 1:680,000

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

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E: wa-id
L: Fig 1-2
6/22/2000

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 20, 2001

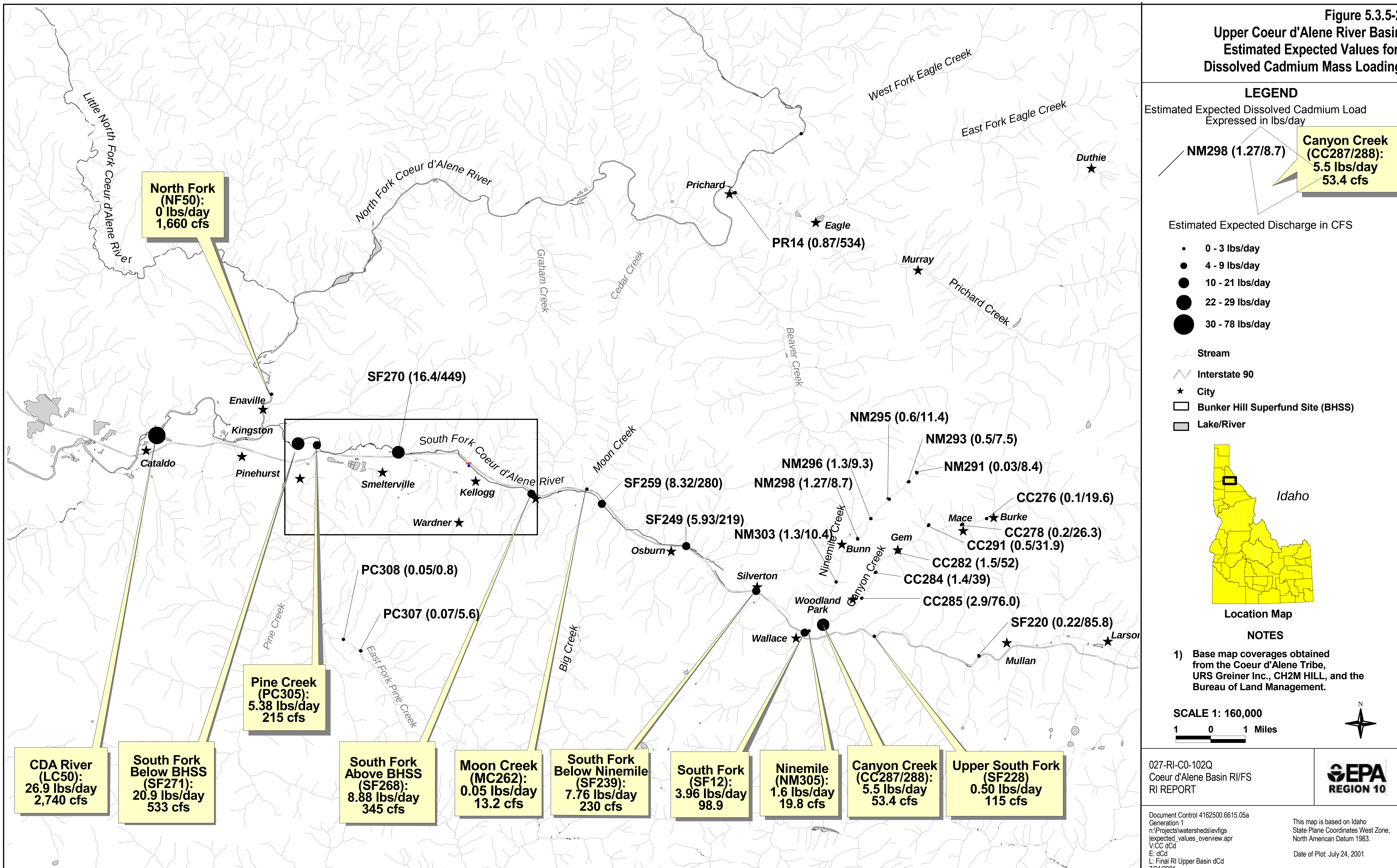
Figure 5.3.5-2
Upper Coeur d'Alene River Basin
Estimated Expected Values for
Dissolved Cadmium Mass Loading
LEGEND
Estimated Expected Dissolved Cadmium Load Expressed in lbs/day
NM298 (1.27/8.7)
Canyon Creek (CC287/288): 5.5 lbs/day 53.4 cfs
Estimated Expected Discharge in CFS
0 - 3 lbs/day
4 - 9 lbs/day
10 - 21 lbs/day
22 - 29 lbs/day
30 - 78 lbs/day
Stream
Interstate 90
City
Bunker Hill Superfund Site (BHSS)
Lake/River
Idaho
Location Map
NOTES
1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.
SCALE 1: 160,000
1 0 1 Miles
N
027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT
EPA REGION 10
Document Control 4162500.6615.05a
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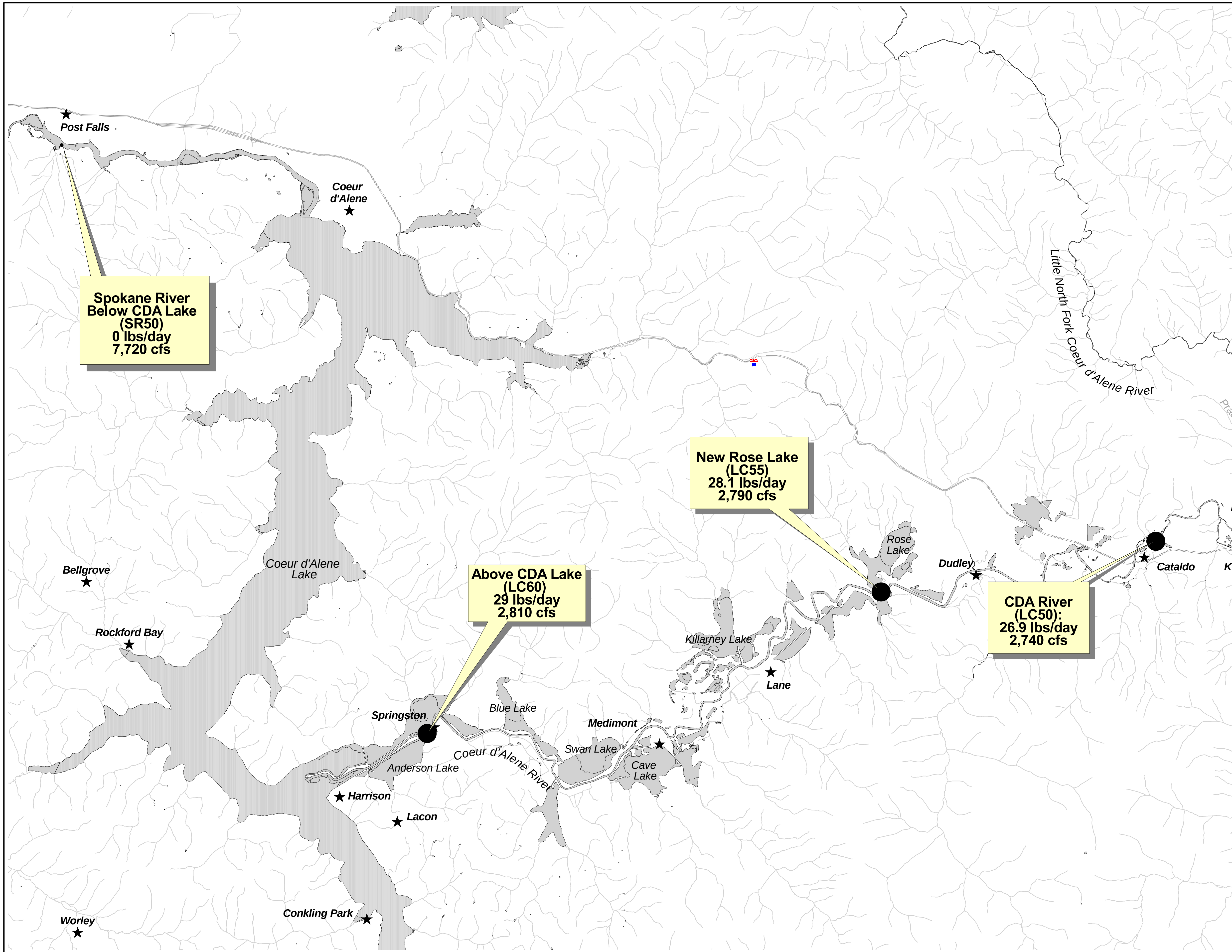
|expected_values_overview.apr
V:CC dCd
E: dCd
L: Final RI Upper Basin dCd
7/24/2001
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.
Date of Plot: July 24, 2001
North Fork (NF50): 0 lbs/day 1,660 cfs
Little North Fork Coeur d'Alene River
North Fork Coeur d'Alene River
West Fork Eagle Creek
East Fork Eagle Creek
Prichard
Eagle
Duthie
Murray
Prichard Creek
PR14 (0.87/534)
Graham Creek
Cedar Creek
Beaver Creek
Enaville
Kingston
Cataldo
Pinehurst
Smelterville
Kellogg
Wardner
SF270 (16.4/449)
South Fork Coeur d'Alene River
Moon Creek
SF259 (8.32/280)
SF249 (5.93/219)
Osburn
Silverton
NM295 (0.6/11.4)
NM293 (0.5/7.5)
NM296 (1.3/9.3)
NM291 (0.03/8.4)
NM298 (1.27/8.7)
NM303 (1.3/10.4)
Ninemile Creek
Bunn
CC276 (0.1/19.6)
Mace
Burke
CC278 (0.2/26.3)
CC291 (0.5/31.9)
Gem
CC282 (1.5/52)
Canyon Creek
CC284 (1.4/39)
CC285 (2.9/76.0)
Woodland Park
Wallace
SF220 (0.22/85.8)
Mullan
Larson
PC308 (0.05/0.8)
PC307 (0.07/5.6)
Pine Creek
East Fork Pine Creek
Big Creek
CDA River (LC50): 26.9 lbs/day 2,740 cfs
South Fork Below BHSS (SF271): 20.9 lbs/day 533 cfs
Pine Creek (PC305): 5.38 lbs/day 215 cfs
South Fork Above BHSS (SF268): 8.88 lbs/day 345 cfs
Moon Creek (MC262): 0.05 lbs/day 13.2 cfs
South Fork Below Ninemile (SF239): 7.76 lbs/day 230 cfs
South Fork (SF12): 3.96 lbs/day 98.9
Ninemile (NM305): 1.6 lbs/day 19.8 cfs
Canyon Creek (CC287/288): 5.5 lbs/day 53.4 cfs
Upper South Fork (SF228): 0.50 lbs/day 115 cfs

Figure 5.3.5-3
Coeur d'Alene Lake and Lower Coeur d'Alene River Estimated Expected Values for Dissolved Cadmium Mass Loading



LEGEND

Estimated Expected Total Lead Load Expressed in lbs/day

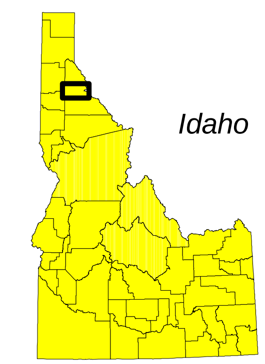
LC55 (28.1/2,790)

CDA River (LC50) 26.9 lbs/day 2,740 cfs

Estimated Expected Load Discharge in CFS

- 0 - 3 lbs/day
- 4 - 9 lbs/day
- 10 - 21 lbs/day
- 22 - 29 lbs/day
- 30 - 78 lbs/day

Stream
Interstate 90
City
Lake/River



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 160,000

1 0 1 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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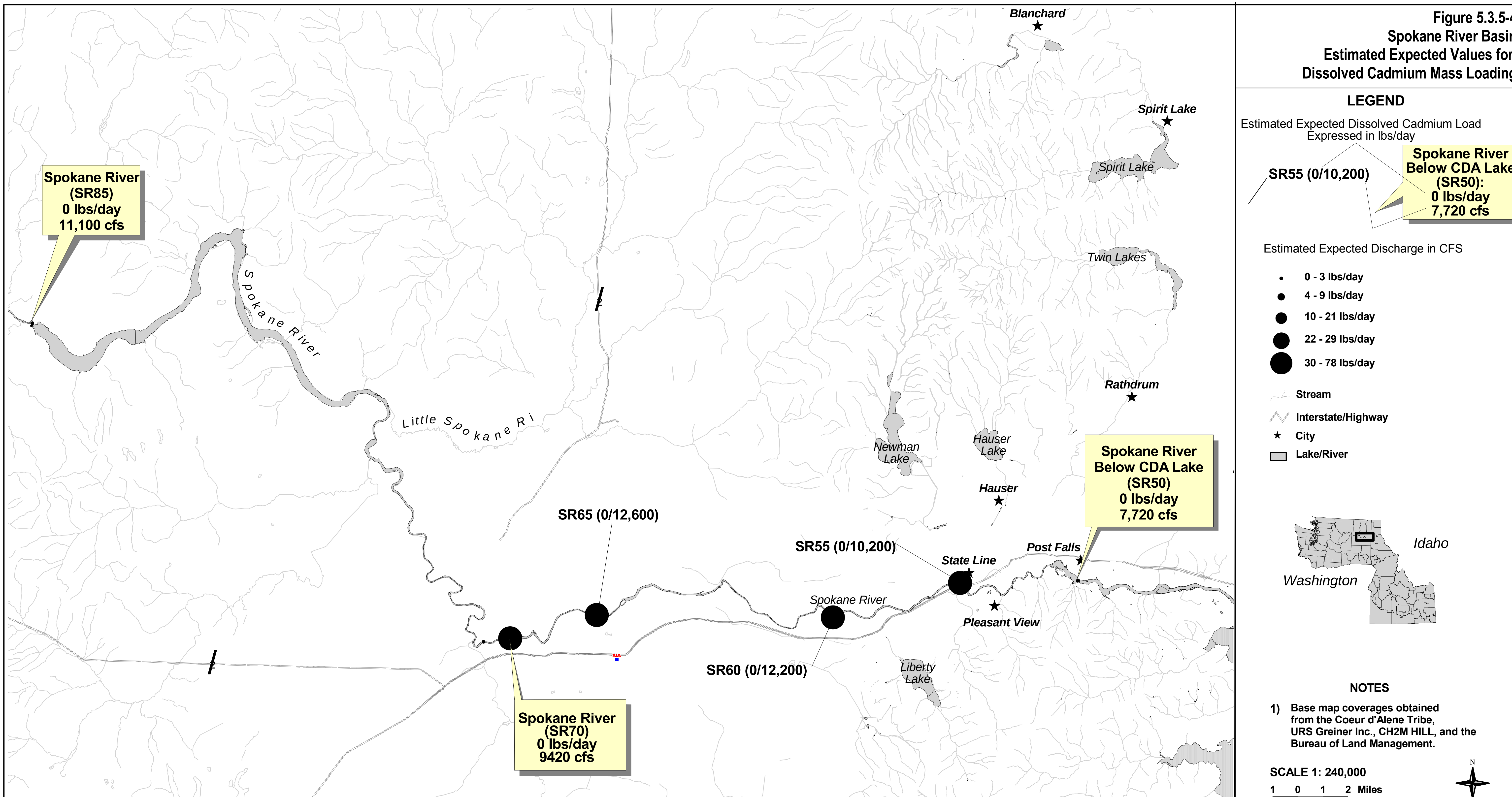
V:Lake dCd
E: dCd
L: Final RI Lake dCd
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

Figure 5.3.5-4
Spokane River Basin
Estimated Expected Values for
Dissolved Cadmium Mass Loading



NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
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E: Spokane dCd
L: Final RI Spokane dCd
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

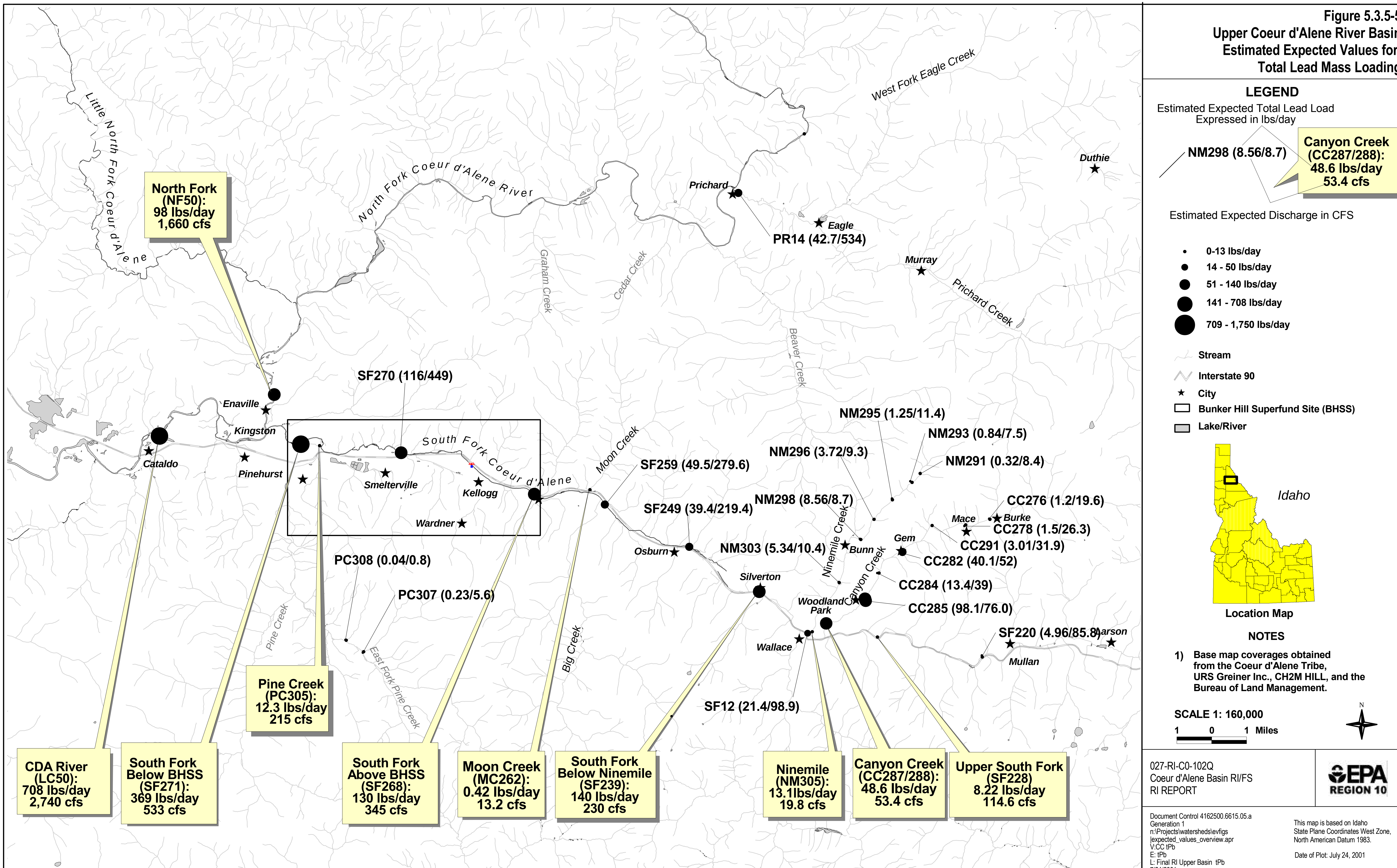

Figure 5.3.5-5
Upper Coeur d'Alene River Basin Estimated Expected Values for Total Lead Mass Loading

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
n:\Projects\watersheds\evfigs
\expected_values_overview.apr
V:CC tPb
E: tPb
L: Final RI Upper Basin tPb
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

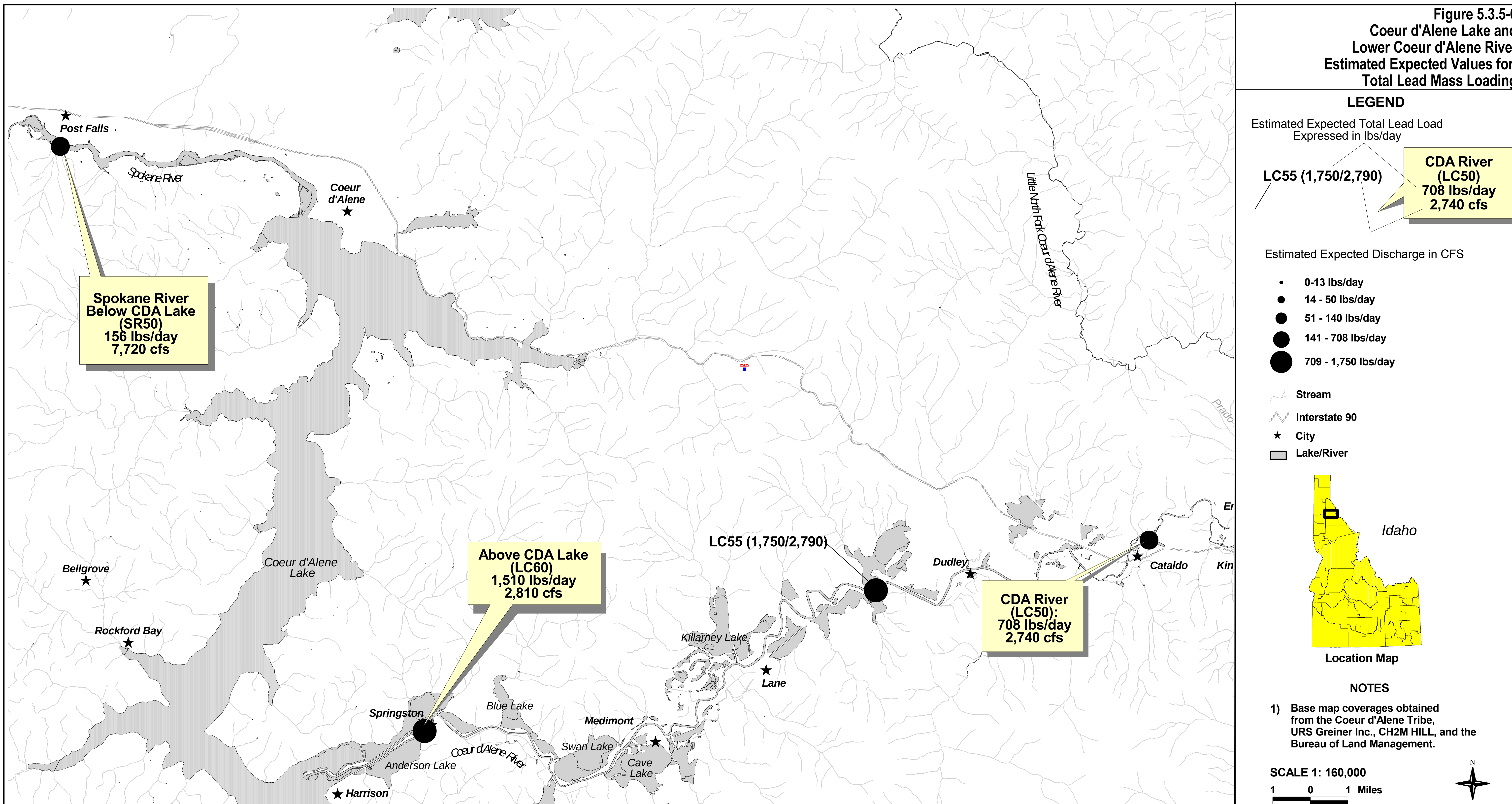

Figure 5.3.5-6
Coeur d'Alene Lake and Lower Coeur d'Alene River Estimated Expected Values for Total Lead Mass Loading

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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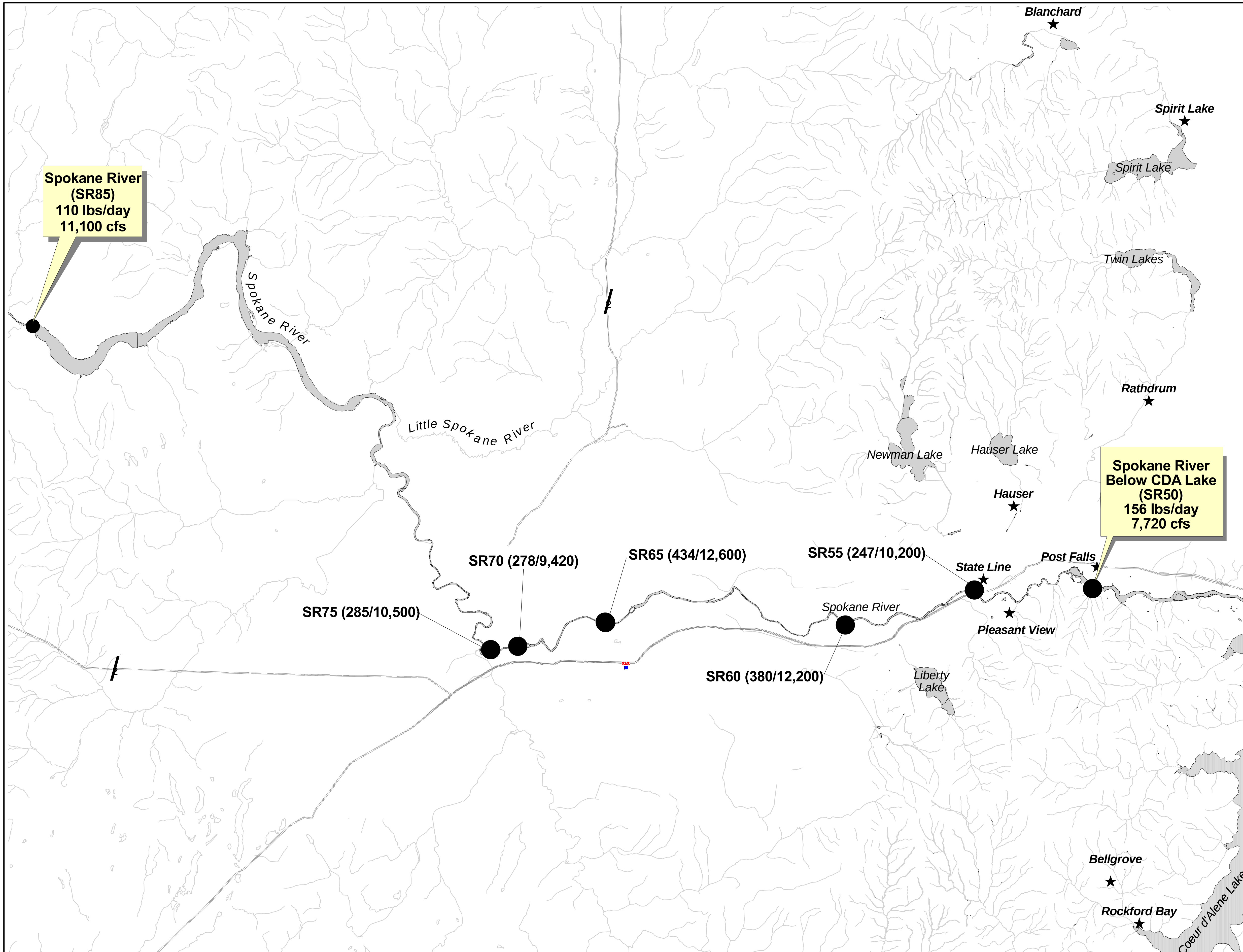
\expected_values_overview.apr
V:Lake tPb
E: tPb
L: Final RI Lake tPb
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

Figure 5.3.5-7
Spokane River
Estimated Expected Values for
Total Lead Mass Loading



LEGEND

Estimated Expected Total Lead Load Expressed in lbs/day

SR55 (247/10,200)

Spokane River Below CDA Lake (SR50) 156 lbs/day 7,720 cfs

Estimated Expected Discharge in CFS

- 0-13 lbs/day
- 14 - 50 lbs/day
- 51 - 140 lbs/day
- 141 - 708 lbs/day
- 709 - 1,750 lbs/day
- Stream
- Interstate 90
- City
- Lake/River

Idaho

Washington

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 240,000

2 0 2 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

REGION 10

Document Control 4162500.6615.05.a
Generation 1
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V:Spokane tPb
E: tPb
L: Final RI Spokane tPb
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

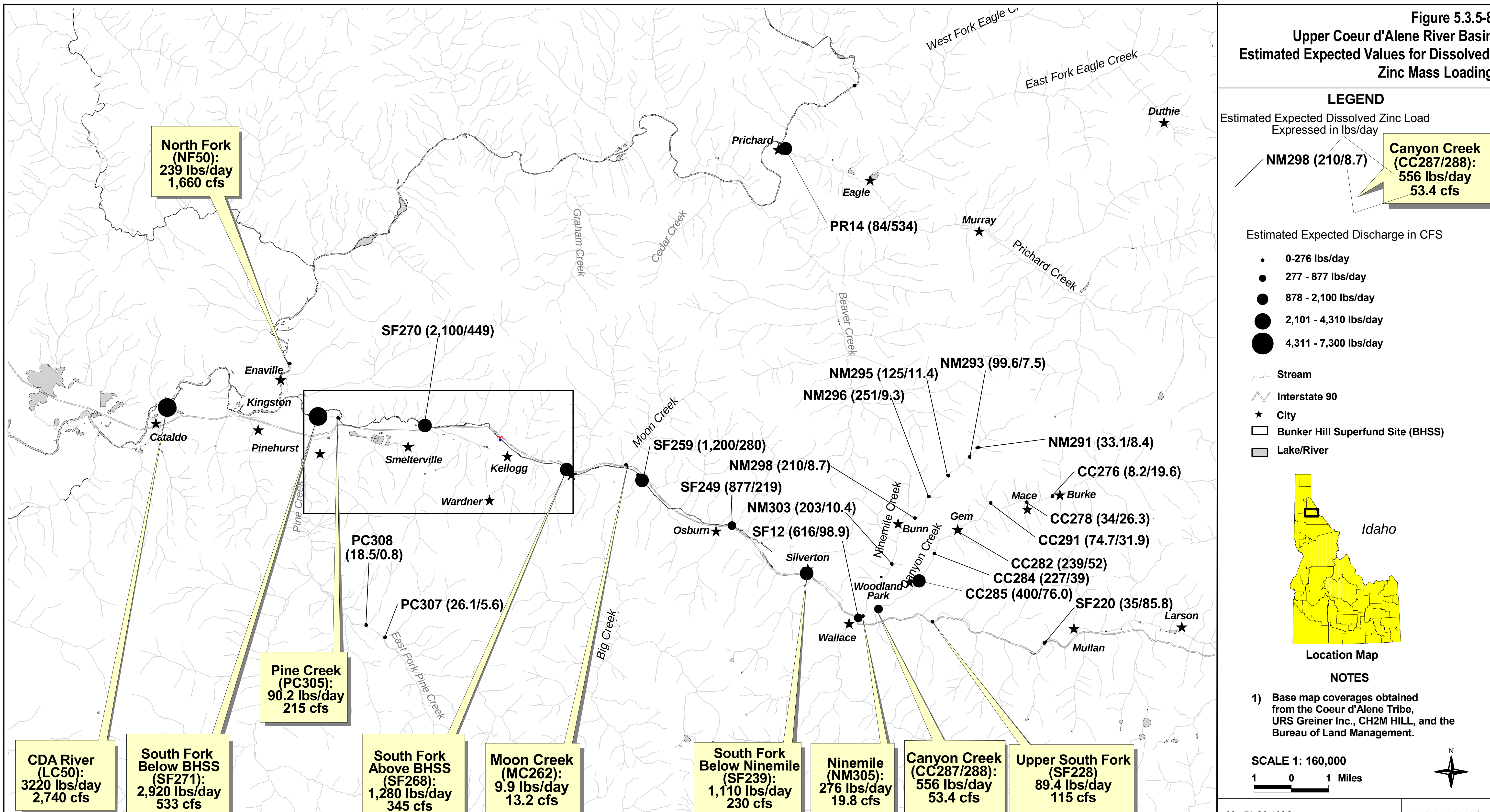

Figure 5.3.5-8
Upper Coeur d'Alene River Basin
Estimated Expected Values for Dissolved Zinc Mass Loading

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
n:\Projects\watersheds\evfigs
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V:copy of Canyon Creek
E: Watershed
L: Final RI Upper Basin
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

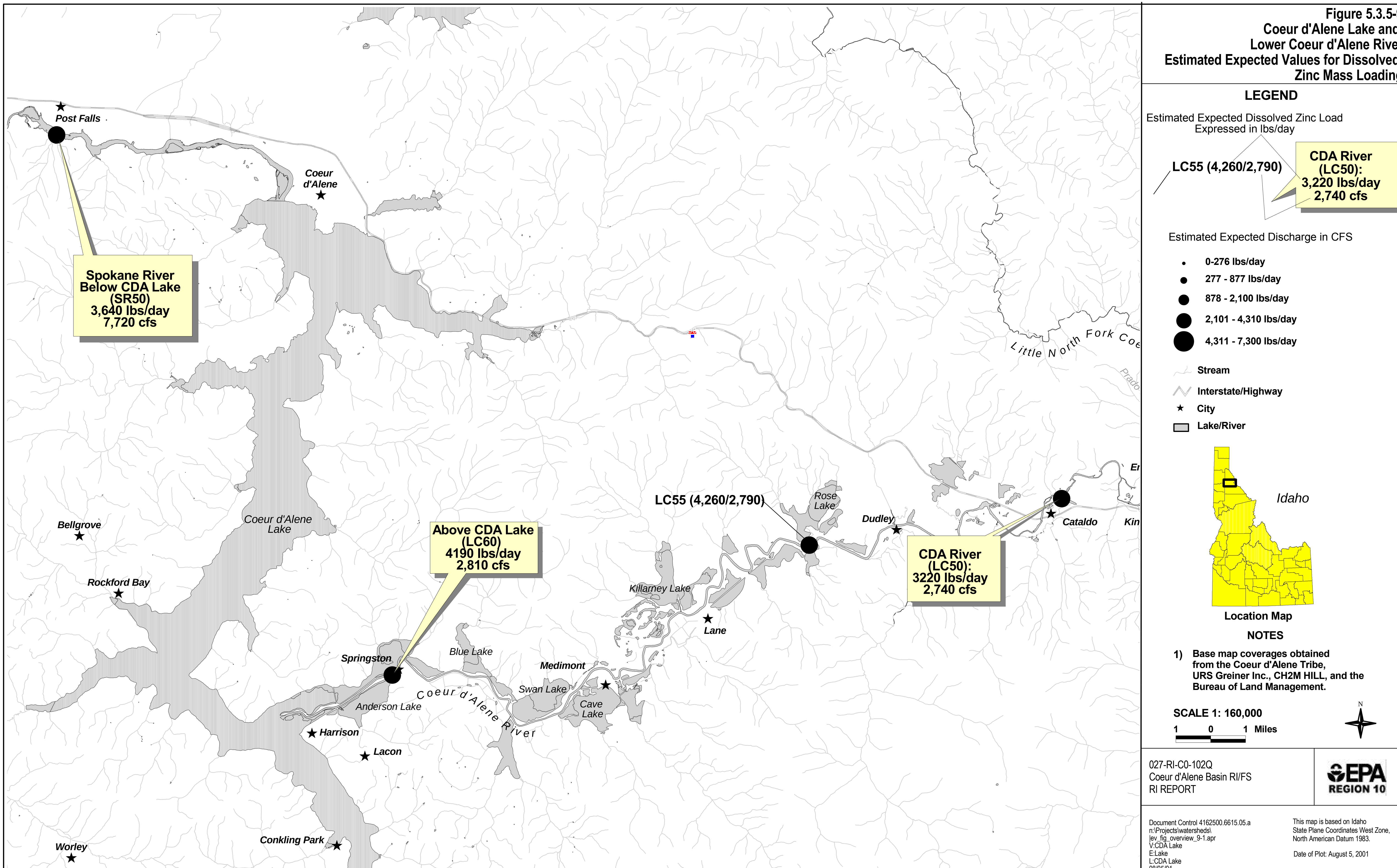
Figure 5.3.5-9
Coeur d'Alene Lake and
Lower Coeur d'Alene River
Estimated Expected Values for Dissolved
Zinc Mass Loading
LEGEND
Estimated Expected Dissolved Zinc Load
Expressed in lbs/day
LC55 (4,260/2,790)
CDA River
(LC50):
3,220 lbs/day
2,740 cfs
Estimated Expected Discharge in CFS
0-276 lbs/day
277 - 877 lbs/day
878 - 2,100 lbs/day
2,101 - 4,310 lbs/day
4,311 - 7,300 lbs/day
Stream
Interstate/Highway
City
Lake/River
Idaho
Location Map
NOTES
1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.
SCALE 1: 160,000
1 0 1 Miles
N
027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT
EPA
REGION 10
Document Control 4162500.6615.05.a
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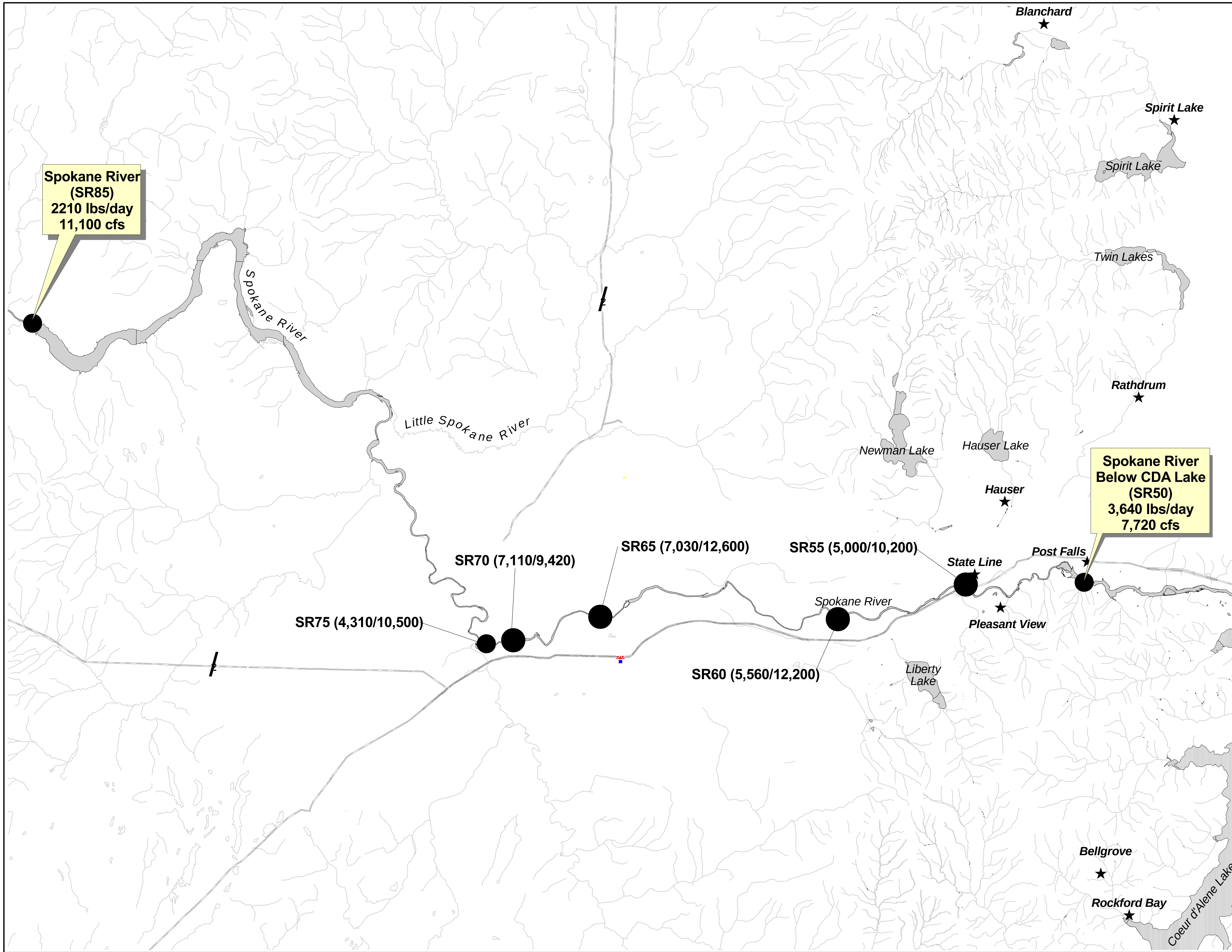
V:CDA Lake
E:Lake
L:CDA Lake
08/05/01
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.
Date of Plot: August 5, 2001
Post Falls
Spokane River
Below CDA Lake
(SR50)
3,640 lbs/day
7,720 cfs
Coeur
d'Alene
Coeur d'Alene
Lake
Bellgrove
Rockford Bay
Worley
Conkling Park
Harrison
Lacon
Springston
Anderson Lake
Above CDA Lake
(LC60)
4190 lbs/day
2,810 cfs
Blue Lake
Medimont
Swan Lake
Cave
Lake
Coeur d'Alene River
Killarney Lake
Lane
LC55 (4,260/2,790)
Rose
Lake
Dudley
CDA River
(LC50):
3220 lbs/day
2,740 cfs
Cataldo
Little North Fork Coe

Figure 5.3.5-10
Spokane River Basin
Estimated Expected Values for
Dissolved Zinc Mass Loading



LEGEND

Estimated Expected Dissolved Zinc Expressed in lbs/day

SR55 (5,000/10,200)

Spokane River Below CDA Lake (SR50) 3,640 lbs/day 7,720 cfs

Estimated Expected Load

- 0-276 lbs/day
- 277 - 877 lbs/day
- 878 - 2,100 lbs/day
- 2,101 - 4,310 lbs/day
- 4,311 - 7,300 lbs/day
- Stream
- Interstate/Highway
- City
- Lake/River

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 240,000

1 0 1 2 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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V:Spokane River
E: Spokane River
L: Spokane River
08/05/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 5, 2001

Table 5.1.1-1
Probability Average Concentrations Exceed Screening Levels

Source Type	Arsenic	Cadmium	Lead	Zinc
Adit and Seep Drainage	0 %	94 %	89 %	96 %
Floodplain Sediments	91 %	97 %	100 %	94 %
Floodplain Tailings	94 %	99 %	100 %	100 %
Floodplain Waste Rock	100 %	94 %	99 %	87 %
Upland Concentrates and Process Wastes	100 %	100 %	100 %	100 %
Upland Tailings	57 %	54 %	100 %	92 %
Upland Waste Rock	84 %	45 %	100 %	85 %

Table 5.1.1-2
Source Areas Identified as Potential Significant Mass Loading Sources in CSM Units 1 and 2

Watershed	Source Areas
Upper South Fork	Morning No. 6 mine and mill site Grouse Gulch (Star) adit drainage and waste piles Golconda mine and mill site
Canyon Creek	Hercules No. 5 waste pile and adit drainage Hecla-Star Complex (including the Tiger-Poorman and Hidden Treasure mine sites) Standard-Mammoth vicinity (including the Standard-Mammoth Loading Area) Tamarack No. 7 adit drainage and waste pile Gem No. 3 adit drainage and mill site Frisco-Black Bear area Impacted floodplain areas within CCSeg04 Hecla-Star Tailings Ponds Impacted floodplain areas within CCSeg05
Ninemile Creek	Success mine and mill Rex No. 2 /16-to-1 mine and mill Tamarack mine and mill Dayrock mine, mill, and tailings repository
South Fork	Impacted floodplain areas

Table 5.1.1-3
Tamarack No. 7 Soil Metals Concentrations

	Cadmium Concentration in mg/kg (SL = 9.8)		Lead Concentration in mg/kg (SL = 171)		Zinc Concentration in mg/kg (SL = 280)	
Sampling Locations	Min	Max	Min	Max	Min	Max
Waste Rock: CC426, CC429, CC430, CC431, CC432	1.4J	**146**	17.2	**63,700**	31.7	**25,800**
Subsurface Alluvium: CC422	1.9 J	1.9 J	**307**	**1320**	**393**	**479**
Offsite: CC427, CC428, CC2009	0.014	3.4	104	**311**	145	245

Notes:
J - estimated value
mg/kg - milligram per kilogram
SL - screening level
Bold indicates screening level exceedance

Table 5.1.1-4
Tamarack No. 7 Surface Sediment/Alluvium Metals Concentrations

	Cadmium Concentration in mg/kg (SL = 9.8)		Lead Concentration in mg/kg (SL = 171)		Zinc Concentration in mg/kg (SL = 280)	
Sampling Locations	Min	Max	Min	Max	Min	Max
CC1369 – CC1378	0.41	**16.5**	4.11	**1,810**	18.3	**20,700**

Note:
mg/kg - milligram per kilogram
SL - screening level
Bold indicates screening level exceedance

Table 5.1.1-5
Tamarack No. 7 Groundwater Dissolved Metals Concentrations

	Dissolved Cadmium Concentration in µg/L (SL = 0.38)		Dissolved Lead Concentration in µg/L (SL = 1.09)		Dissolved Zinc Concentration in µg/L (SL = 42)	
Sampling Locations	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
CC422 (shallow alluvium)	**109**	**212**	**343**	**692**	**18,300**	**33,400**
CC431, CC432, CC437 (waste rock pile)	ND	**0.98 J**	ND	**1.7 J**	1.6 J	35.7

Notes:
J - estimated value
ND - not detected
SL - screening level
µg/L - microgram per liter
Bold indicates screening level exceedance

Table 5.1.1-6
Tamarack No. 7 Surface Water Dissolved Metals Concentrations

	Dissolved Cadmium Concentration in µg/L (SL = 0.38)		Dissolved Lead Concentration in µg/L (SL =1.09)		Dissolved Zinc Concentration in µg/L (SL = 42)	
Sampling Locations	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Adit: CC372	**1.3**	**16.6**	ND	0.13	**501**	**2,790**
River: CC279, CC280, CC291, CC425, CC438	**1**	**8.7**	**3**	**20**	**128**	**1,400**

Note:
ND - not detected
SL - screening level
µg/L - microgram per liter
Bold indicates screening level exceedance

Table 5.1.1-7
Rex No. 2 Soil Metals Concentrations

Sampling Locations	Cadmium Concentration in mg/kg (SL = 9.8)		Lead Concentration in mg/kg (SL = 171)		Zinc Concentration in mg/kg (SL = 280)	
	Min	Max	Min	Max	Min	Max
Waste Rock: NM1605 – NM1611, NM421 – NM423	0.45 J	**211**	6.5	**46,600**	41.1	**127,000**
Tailings: NM1603, NM1604, NM1612, NM413 – NM417, NM444, NM461, NM462	3.3	**39 J**	**1,280**	**16,100**	**1,110**	**16,300**
Offsite: NM1601, NM1630 – NM1634, NM2001	0.79	**18**	10.7	**1,470**	55.1	**1,750**

Notes:
J - estimated value
mg/kg - milligram per kilogram
SL - screening level
Bold indicates screening level exceedance

Table 5.1.1-8
Rex No. 2 Groundwater Dissolved Metals Concentrations

Sampling Locations	Dissolved Cadmium Concentration in µg/L (SL = 0.38)		Dissolved Lead Concentration in µg/L (SL = 1.09)		Dissolved Zinc Concentration in µg/L (SL = 42)	
	Min	Max	Min	Max	Min	Max
Waste Rock: NM422	**5.3**	**7.8**	ND	**2 J**	**765**	**1,180**
Tailings: NM444	**6.8**	**9.7**	0.54 J	**2**	**3,620**	**4,440**

Notes:
J - estimated value
ND - not detected
SL - screening level
µg/L - microgram per liter
Bold indicates screening level exceedance

Table 5.1.1-9
Rex No. 2 Surface Water Dissolved Metals Concentrations

Sampling Locations	Dissolved Cadmium Concentration in µg/L (SL = 0.38)		Dissolved Lead Concentration in µg/L (SL =1.09)		Dissolved Zinc Concentration in µg/L (SL = 42)	
	Min	Max	Min	Max	Min	Max
Adit: NM361	**6.2**	**12**	**44.8**	**110**	**1,350**	**2,550**
Seep from Tailings Pile: NM368	**15.3**	**17**	**1.83**	**98.9**	**3,270**	**8,330**
Surface Flow from Seep: NM411	**22.8**	**22.8**	ND	ND	**10,000**	**10,000**

Notes:
ND - not detected
SL - screening level
µg/L - microgram per liter
Bold indicates screening level exceedance

Table 5.1.1-10
South Fork Impacted Floodplain (Osburn Flats Area)
Soil/Sediment Metals Concentrations

Sampling Locations	Cadmium Concentration in mg/kg (SL = 9.8)		Lead Concentration in mg/kg (SL = 171)		Zinc Concentration in mg/kg (SL = 280)	
	Min	Max	Min	Max	Min	Max
SF506, SF508, SF509, SF512, SF513, SF515-519, SF541, SF543, SF544, SF11298-302	5.27 J	**64.4**	111	**33,800**	**922**	**8,570**

Notes:
J - estimated value
mg/kg - microgram per kilogram
SL - screening level
Bold indicates screening level exceedance

Table 5.1.1-11
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (µg/L)	Average total zinc load (lbs/day)
Adits						
KLE054	Hooper Tunnel	Big Creek	0.1	0.082	190	0.10
POL002	Silver Dale and Big Hill	Big Creek	0.0156	0.0156	3	0.00025
POL004	Bismarck	Big Creek	0.0112	0.0112	3	0.00018
POL022	First National	Big Creek	0.001	0.001	4	0.000022
POL067	Unnamed adit	Big Creek	No data	No data	10	No discharge data
POL001	Sunshine Cons.-Rockford Group	Big Creek	No data	No data	No data	No data
POL024	Royal Apex	Big Creek	No data	No data	No data	No data
BUR190	Gem No.3	Canyon Creek	0.36	1.0	15,000	29
BUR098	Hercules No. 5	Canyon Creek	1.96	3.0	1,693	18
BUR067	Tamarack No. 7	Canyon Creek	1.58	3.15	1,437	12
BUR097	Hidden Treasure (Tiger-Poorman)	Canyon Creek	1.44	1.44	392	3.0
BUR121	Black Bear Fraction	Canyon Creek	1.13	1.13	91	0.55
BUR128	Hecla No. 3	Canyon Creek	0.33	0.33	63	0.11
BUR096	Anchor	Canyon Creek	0.0081	0.0081	22	0.00097
BUR132	Gertie	Canyon Creek	0.6	0.6	No data	No data
WAL011	Canyon Silver (Formosa)	Canyon Creek	No data	No data	208	No discharge data
BUR073	Standard-Mammoth Campbell Adit	Canyon Creek	No data	No data	No data	No data
BUR076	Sherman 1500 Level	Canyon Creek	No data	No data	No data	No data
BUR085	Hercules No. 1	Canyon Creek	No data	No data	No data	No data
BUR087	Hercules No. 3	Canyon Creek	No data	No data	No data	No data
BUR088	Ajax No. 2	Canyon Creek	No data	No data	No data	No data
BUR091	Trade Dollar	Canyon Creek	No data	No data	No data	No data
BUR099	Benton	Canyon Creek	No data	No data	No data	No data
BUR107	Ajax No. 3	Canyon Creek	No data	No data	No data	No data
BUR109	Oom Paul No. 1	Canyon Creek	No data	No data	No data	No data
BUR112	Gem No. 2	Canyon Creek	No data	No data	No data	No data
BUR114	West Star	Canyon Creek	No data	No data	No data	No data
BUR123	Great Eastern	Canyon Creek	No data	No data	No data	No data

Table 5.1.1-11 (Continued)
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (μg/L)	Average total zinc load (lbs/day)
BUR124	Omaha	Canyon Creek	No data	No data	No data	No data
BUR129	Tiger-Poorman	Canyon Creek	No data	No data	No data	No data
BUR134	Alcides Prospect & Imperial Mine	Canyon Creek	No data	No data	No data	No data
BUR185	West Mammoth	Canyon Creek	No data	No data	No data	No data
BUR188	Coeur d'Alene Champion	Canyon Creek	No data	No data	No data	No data
THO018	Half Moon (Blue Ribbon Group)	Canyon Creek	No data	No data	No data	No data
KLE076	Silver Crescent	Moon Creek	Closed by USFS			
KLE078	Charles Dickens	Moon Creek	Closed by USFS			
OSB089	Success No. 3	Ninemile Creek	0.019	0.035	62,100	6.3
BUR054	Rex No. 2	Ninemile Creek	0.017	0.027	1,995	0.18
BUR170	Tamarack 400 Level	Ninemile Creek	0.083	0.083	111	0.050
BUR171	Tamarack No. 5	Ninemile Creek	0.032	0.061	195	0.034
BUR053	Interstate-Callahan	Ninemile Creek	0.072	0.14	60	0.023
OSB055	Silver Star	Ninemile Creek	0.0096	0.0096	125	0.0065
OSB039	Dayrock	Ninemile Creek	0.0068	0.0068	76	0.0028
BUR051	Sunset	Ninemile Creek	No data	No data	28,400	No discharge data
BUR056	Tamarack Rock Dumps	Ninemile Creek	No data	No data	No data	No data
BUR058	Tamarack No. 3	Ninemile Creek	No data	No data	No data	No data
BUR081	Guelph	Ninemile Creek	No data	No data	No data	No data
OSB032	Duluth (Blackcloud Cr.)	Ninemile Creek	No data	No data	No data	No data
OSB054	Thomas Consolidated Shaft	Ninemile Creek	No data	No data	No data	No data
OSB087	Unnamed tunnel	Ninemile Creek	No data	No data	No data	No data
OSB088	Alameda	Ninemile Creek	No data	No data	No data	No data
MAS020	Sidney (Red Cloud)	Pine Creek	0.018	0.089	43,700	4.2
MAS021	Nevada-Stewart	Pine Creek	0.074	0.111	9,833	3.9
MAS007	Nabob 1300 Level	Pine Creek	0.051	0.074	7,665	2.1
MAS078	Highland Surprise	Pine Creek	0.038	0.04	2,853	0.58

Table 5.1.1-11 (Continued)
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (μg/L)	Average total zinc load (lbs/day)
MAS050	Constitution Upper Tunnel	Pine Creek	0.079	0.098	328	0.14
MAS016	Little Pittsburg No. 1	Pine Creek	0.00042	0.00042	61,400	0.14
MAS015	Little Pittsburg No. 2	Pine Creek	0.00174	0.00179	8,150	0.076
MAS011	Idaho Prospect No. 2	Pine Creek	0.00064	0.00064	10,500	0.036
MAS004	Lookout Mountain	Pine Creek	0.0268	0.027	49	0.0071
MAS054	SF Fraction (Marmion)	Pine Creek	0.0089	0.0089	111	0.0053
KLW081	Amy-Matchless	Pine Creek	0.0043	0.00821	211	0.0049
MAS003	Liberal King	Pine Creek	0.0046	0.00656	58	0.0014
MAS029	Big It	Pine Creek	0.00106	0.00106	36	0.00021
MAS009	Shetland Mining Co.	Pine Creek	0.000651	0.000825	14	0.000049
MAS012	Lynch-Pine Creek	Pine Creek	No data	No data	15,900	No discharge data
MAS014	Hilarity	Pine Creek	No data	No data	6,230	No discharge data
MAS017	Sidney (Denver) 500 Level	Pine Creek	No data	No data	3,460	No discharge data
MAS052	Owl/Fred	Pine Creek	No data	No data	452	No discharge data
MAS010	Idaho Prospect No. 1	Pine Creek	No data	No data	No data	No data
MAS023	Blue Eagle	Pine Creek	No data	No data	No data	No data
MAS025	Douglas	Pine Creek	No data	No data	No data	No data
MUL085	Vienna International	South Fork	0.356	0.356	32	0.061
KLE067	St. Joe No. 4	South Fork	0.0055	0.007	455	0.013
OSB080	Harlow Tunnel	South Fork	0.0022	0.0022	3	0.000036
OSB076	Unnamed adit (May Claim)	South Fork	0.0011	0.0011	3	0.000018
OSB074	St. Joe No. 1	South Fork	No data	No data	2,700	No discharge data
WAL020	Caladay	South Fork	No data	No data	46	No discharge data
KLE034	Silver Dollar	South Fork	No data	No data	No data	No data
KLE035	Silver Summit	South Fork	No data	No data	No data	No data
KLE068	St. Joe No. 2	South Fork	No data	No data	No data	No data

Table 5.1.1-11 (Continued)
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (µg/L)	Average total zinc load (lbs/day)
KLE069	St. Joe No. 3	South Fork	No data	No data	No data	No data
OSB079	Capital Silver Main Adit	South Fork	No data	No data	No data	No data
POL018	Merger	South Fork	No data	No data	No data	No data
POL019	Coeur d'Alene	South Fork	No data	No data	No data	No data
WAL002	Western Union Lower Adit	South Fork	No data	No data	No data	No data
WAL015	Coeur (Rainbow)	South Fork	No data	No data	No data	No data
MUL012	Star 1200 Level	Upper South Fork	0.43	0.70	7,010	16
MUL019	Morning No. 6	Upper South Fork	1.18	1.85	167	1.1
MUL014	Grouse Mine	Upper South Fork	1.82	1.82	84	0.82
MUL028	Morning No. 5	Upper South Fork	0.0547	0.088	1,616	0.48
LOK011	Snowstrom No. 3	Upper South Fork	5.74	12	12	0.37
MUL027	Morning No. 4	Upper South Fork	0.0152	0.0152	950	0.078
MUL053	National Mine	Upper South Fork	0.174	0.174	35	0.033
MUL052	Copper King	Upper South Fork	0.084	0.112	40	0.018
MUL001	Golconda	Upper South Fork	0.0304	0.0388	18	0.0029
MUL054	Unnamed adit	Upper South Fork	0.007	0.007	51	0.0019
LOK004	Snowshoe No. 2	Upper South Fork	0.112	0.112	3	0.0018
MUL072	Lower Giant	Upper South Fork	0.0223	0.0223	3	0.00036
MUL081	Reindeer Queen	Upper South Fork	0.0075	0.011	8	0.00032

Table 5.1.1-11 (Continued)
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (μg/L)	Average total zinc load (lbs/day)
LOK017	Beacon Light	Upper South Fork	0.0045	0.0045	3	0.000073
LOK019	Princeton Magna	Upper South Fork	0.0003	0.0003	21	0.000034
LOK024	Silver Cable	Upper South Fork	No data	No data	1,100	No discharge data
LOK028	Hunter-Snowstorm Lode	Upper South Fork	No data	No data	10	No discharge data
MUL023	Fanny Gremm	Upper South Fork	No data	No data	40	No discharge data
MUL024	You Like	Upper South Fork	No data	No data	2,310	No discharge data
MUL071	Atlas	Upper South Fork	No data	No data	201	No discharge data
LOK002	Lucky Calumet No. 2	Upper South Fork	No data	No data	No data	No data
LOK008	Idaho Silver No. 2	Upper South Fork	No data	No data	No data	No data
LOK014	Pandora	Upper South Fork	No data	No data	No data	No data
MUL006	Square Deal	Upper South Fork	No data	No data	No data	No data
MUL008	Alice	Upper South Fork	No data	No data	No data	No data
MUL013	We Like	Upper South Fork	No data	No data	No data	No data
MUL103	Missoula	Upper South Fork	No data	No data	No data	No data
Seeps						
WAL009	Hecla-Star Tailings Ponds	Canyon Creek	1.03	1.1	1,400	7.8
WAL041	Canyon Cr. Repository Reach	Canyon Creek	0.02	0.02	32,000	3.4
BUR107	Ajax No. 3	Canyon Creek	No data	No data	No data	No data

Table 5.1.1-11 (Continued)
Adit and Seep Data, CSM Units 1 and 2

BLM ID	Source Name	Watershed	Average discharge (cfs)	Maximum Discharge (cfs)	Average total zinc concentration (µg/L)	Average total zinc load (lbs/day)
BUR055	Interstate-Callahan Mill	Ninemile Creek	0.0043	0.007	350,000	8.1
BUR054	Rex No. 2	Ninemile Creek	0.03	0.03	11,400	1.8
BUR053	Interstate-Callahan Rock Dumps	Ninemile Creek	1.8	4.27	182	1.8
OSB044	Success	Ninemile Creek	No data	No data	No data	No data
KLW081	Amy-Matchless	Pine Creek	0.426	0.68	888	2.0
MAS078	Highland-Surprise	Pine Creek	0.0106	0.0106	7,700	0.44
MAS021	Nevada-Stewart	Pine Creek	0.0028	0.0028	2,735	0.04
MAS014	Hilarity	Pine Creek	No data	No data	7,500	No discharge data
MAS036	Denver Cr. tailings pile	Pine Creek	No data	No data	3,690	No discharge data
MAS003	Liberal King	Pine Creek	No data	No data	1,430	No discharge data
MAS049	Upper Constitution (non-BLM land)	Pine Creek	No data	No data	1,300	No discharge data
MAS015	Little Pittsburg No. 2	Pine Creek	No data	No data	640	No discharge data
MAS026	Upper Constitution (BLM land)	Pine Creek	No data	No data	111	No discharge data
MAS067	Lookout Mountain	Pine Creek	No data	No data	17	No discharge data
OSB120	Osburn Flats seep	South Fork	0.06	0.06	6,545	2.1
MUL085	Vienna International	South Fork	No data	No data	3	No discharge data
MUL019	Morning No. 6 waste rock	Upper South Fork	1.71	2.37	116	1.1

Notes:
Data compiled from the Restoration Alternatives Plan (Gearheart et al. 1999). See Appendix J.

cfs - cubic feet per second
µg/L - micrograms per liter
lbs/day - pounds per day

Table 5.2-1
Summary of Drinking Water Exceedances of MCLs for Residential Properties

City	Total Number of Homes	Number of Homes With Exceedances of MCL	Chemical Concentrations of Exceedances (µg/L)		Water Source of Exceedances
			Static	Purged	
Black Cloud	2	0	--	--	--
Burke	11	2	Lead = 39.8[a] Antimony = 7.5	Antimony = 7.9	Canyon Creek
Cataldo	2	1	Copper = 2,430[a]	--	Municipal
Gem	1	0	--	--	--
Kellogg	4	1	Lead = 15.7 Nickel = 484	--	Well
Kingston	3	1	Copper = 2,420[a]	--	Municipal
Mullan	7	1	--	Thallium = 2.3	Municipal
Osburn	30	9	Cadmium = 13.4[a], 13.9[a], and 12.9[a] Copper = 1,530[a] Lead = 26.3 and 56.1[a] Thallium = 3.9[a] and 2.9[a]	Cadmium = 9[a], 13.6[a], 11.6[a], and 5.6[a]	5 wells 4 municipal
Pinehurst	4	0	--	--	--
Silverton	4	0	--	--	--
Wallace	11	1	Cadmium = 5.7[a] Lead = 26.9	--	Municipal
Wdlnd Pk	8	0	--	--	--
Cataldo	1	0	--	--	--
Harrison	1	1	Lead = 17.2	--	168-foot well
Mullan	1	0	--	--	--
Osburn	6	2	Lead = 18.2 and 35.3[a]	--	Community well
Wallace	4	3	Lead = 17.2, 78.5[a], and 30.1[a] Cadmium = 33.6[a] Copper = 2,620[a]	Cadmium = 29[a]	1 spring 2 wells

Table 5.2-1 (Continued)
Summary of Drinking Water Exceedances of MCLs for Residential Properties

[a]Concentration exceeding both the maximum contaminant level (MCL) and the Superfund Early Action Level (listed below):

Maximum Contaminant Levels (µg/L):	Superfund Early Action Levels (µg/L):
Antimony = 6	Antimony = 10
Cadmium = 5	Cadmium = 5
Copper = 1,300	Copper = 1,300
Lead = 15	Lead = 30
Nickel = 100	Nickel = 500
Thallium = 2	Thallium = 2

Note: µg/L - microgram per liter

Table 5.2-2
Canyon Creek—Dissolved Zinc in Groundwater in µg/L

Watershed Segment	Sampling Location	Zinc Concentrations by Sampling Interval				
		<10 Feet	10 to 15 Feet	15 to 20 Feet	20 to 30 Feet	>30 Feet
3	CC401				33.2	
2	CC402				510 J	
4	CC403			67.5 J		
4	CC409			384 J		
4	CC414		2,890 J			
4	CC415		6,720 J			
4	CC417		4,330	4,330		
4	CC418				4,360 J	4,200 J
4	CC419		41.8 J	25.8 J		
4	CC422	33,400	33,400			
4	CC423	1,090				
4	CC433		5.4	5 U		5U
4	CC434			5 U		
4	CC440			925		
4	CC441		1,230			
4	CC449		205	227		215
4	CC451	521		529		523
5	CC452		5,180			
5	CC453		36,000	35,100		35,800
5	CC460	5,650	6,580			7,340
5	CC459			41,800	39,400	40,400
5	CC463	20,100	20,200			20,500
5	CC464	40,500			40,200	14,200
5	CC467	9,340	9,210			9,400
5	CC468	2,890	2,880			
5	CC462	37,800	37,500			
5	CC469	16.1	33.7			
5	CC465	6,790	3,050			3,600
5	CC456	978	970		969	
5	CC481		5,820	5,750		

Notes:
Depth intervals are below top of casing
J - estimated value
U - not detected
Blank cells - data were not collected at the specified depth intervals
µg/L - microgram per liter

Table 5.3.4-1
Estimated Expected Dissolved Zinc and Cadmium and Total Lead Concentrations at 10th and 90th Percentile Discharges Compared to Screening Levels

Sampling Location	Discharge at Designated Percentile[1]	Dissolved Cadmium Estimated Expected Value in µg/L	Number of Samples	Total Lead Estimated Expected Value in µg/L	Number of Samples	Dissolved Zinc Estimated Expected Value in µg/L	Number of Samples
NORTH FORK							
NF50 (mouth at Enaville)							
10th Percentile	253	NA	NA	0.74	30	4.74	22
90th Percentile	5,090	NA	NA	2.69	30	8.65	22
SOUTH FORK AND TRIBUTARIES AT MOUTH							
SF239 (Silverton)							
10th Percentile	48	**10.8**	56	**17.9**	56	**1,635**	56
90th Percentile	649	**7.6**	56	**44.5**	56	**493**	56
SF271 (Pinehurst)							
10th Percentile	97	**12.9**	108	**19.5**	69	**2,470**	111
90th Percentile	1,290	**4.7**	108	**57.9**	69	**678**	111
CANYON CREEK							
CC287/288 (at mouth)							
10th Percentile	11	**31.5**	17	**65**	18	**4,430**	18
90th Percentile	149	**8.6**	17	**99**	18	**1,170**	18
NINEMILE CREEK							
NM305 (at mouth)							
10th Percentile	3	**29.9**	96	**45.7**	98	**4,590**	96
90th Percentile	41	**13.0**	96	**105**	98	**2,150**	96

Table 5.3.4-1 (Continued)
Estimated Expected Dissolved Zinc and Cadmium and Total Lead Concentrations at 10th and 90th Percentile Discharges Compared to Screening Levels

Sampling Location	Discharge at Designated Percentile[1]	Dissolved Cadmium Estimated Expected Value in µg/L	Number of Samples	Total Lead Estimated Expected Value in µg/L	Number of Samples	Dissolved Zinc Estimated Expected Value in µg/L	Number of Samples
PINE CREEK							
PC305 (at mouth)[2]							
10th Percentile	29	**0.4**	12	7.5	12	**94.7**	38
90th Percentile	387	**1.2**	12	9.2	12	**126**	38
MAIN STEM							
LC60 (Harrison)							
10th Percentile	348	**2.2**	91	**20.3**	32	**495**	91
90th Percentile	6,870	**1.5**	91	**54.4**	32	**202**	91
SPOKANE RIVER							
SR50 (Post Falls)							
10th Percentile	906	NA	NA	0.6	9	**42.0**	10
90th Percentile	17,400	NA	NA	3.3	9	**80.5**	10

NA - not available
Note:
Bold indicates exceedance of screening level. Screening levels are listed in Tables 3.2-2 and 3.2-3.

Footnotes:
[1] 10^{th} and 90^{th} percentile discharge values from U.S. EPA 2000. TMDL for dissolved cadmium, dissolved lead, and dissolved zinc in surface waters of the Coeur d'Alene Basin. Final. August.
[2] Discharge values from sampling location PC315, just upgradient from sampling location PC305.

Table 5.3.5-1
Comparison of Estimated Expected (Average) Concentrations to Estimated Expected Concentrations at the 10th and 90th Percentile Discharges and Comparison of Estimated Expected (Average) Mass Loading to TMDLs

Watershed	Estimated Expected (Average) Dissolved Cadmium Concentration (µg/L)			Estimated Expected (Average) Total Lead Concentration (µg/L)			Estimated Expected (Average) Dissolved Zinc Concentration (µg/L)			Estimated Expected (Average) Dissolved Cadmium Mass Loading (lbs/day)	Estimated Expected (Average) Total Lead Mass Loading (lbs/day)	Estimated Expected (Average) Dissolved Zinc Mass Loading (lbs/day)
	10th	Avg.	90th	10th	Avg.	90th	10th	Avg.	90th	Average	Average	Average
Prichard Creek (PR14)	NA	❑	NA	NA	❑	NA	NA	■	NA	TMDL not established	TMDL not established	TMDL not established
Beaver Creek [a]	NA	■	NA	NA	❑	NA	NA	■	NA	TMDL not established	TMDL not established	TMDL not established
North Fork CdA River (NF50)	NA	NA	NA	❑	❑	❑	❑	❑	❑	NA	■	❑
Upper South Fork (SF228)	■	■	❑	❑	❑	❑	■	■	■	❑	❑	❑
Canyon Creek (CC287/288)	■	■	■	■	■	■	■	■	■	■	■	■
Ninemile Creek (NM305)	■	■	■	■	■	■	■	■	■	■	■	■
Big Creek (BC260)	NA	■	NA	NA	❑	NA	NA	❑	NA	TMDL not established	TMDL not established	TMDL not established
Moon Creek (MC262)	NA	❑	NA	NA	❑	NA	NA	■	NA	TMDL not established	TMDL not established	TMDL not established
Pine Creek (PC305)	❑	❑	■	❑	❑	❑	■	■	■	■	■	■
South Fork CdA River (Pinehurst) (SF271)	■	■	■	■	■	■	■	■	■	■	■	■
Coeur d'Alene River (Harrison) (LC50)	■	■	■	■	■	■	■	■	■	■	■	■
Coeur d'Alene Lake (Post Falls) (SR50)	NA	NA	NA	❑	❑	❑	■	■	■	b	b	b
Spokane River (Long Lake) (SR85)	NA	NA	NA	NA	❑	NA	NA	■	NA	b	b	b

Table 5.3.5-1 (Continued)
Comparison of Estimated Expected (Average) Concentrations to Estimated Expected Concentrations at the 10th and 90th Percentile Discharges and Comparison of Estimated Expected (Average) Mass Loading to TMDLs

[a]Beaver Creek values are averages from measured results.
[b]TMDLs for the Spokane River are the ambient water quality criteria (in µg/L) adjusted for site-specific hardness concentrations.

Notes:
❑ = Value does not exceed screening level or total maximum daily load (TMDL)
■ = Value exceeds screening level or TMDL
NA - Not applicable. Value not calculated.
µg/L - microgram per liter
lbs/day - pounds per day

Table 5.3.6-1
Estimated Dissolved Cadmium, Lead, and Zinc as a Percentage of the Total Metal Concentration

Sampling Location	Dissolved Cadmium (percent)	Dissolved Lead (percent)	Dissolved Zinc (percent)
SF220 (below Mullan)	100	22	87
SF228 (below Trowbridge Gulch)	84	21	100
Canyon Creek (mouth)	87	6	89
Ninemile Creek (mouth)	96	29	80
SF12 (below mouth of Ninemile Creek)	94	39	97
SF239 (Silverton)	85	11	89
SF249 (Osburn)	97	27	99
SF259 (South Fork above Big Creek)	97	24	95
SF268 (near Elizabeth Park)	89	11	90
Pine Creek (mouth)	93	44	92
SF270 (Smelterville)	97	29	95
SF271 (Pinehurst)	88	8	96
North Fork	NA	4	32
LC50 (Cataldo)	92	9	79
LC55 (Rose Lake)	80	7	85
LC60 (near Harrison)	86	13	77

NA - Not available. Too few data points for calculation.
[1]Results were calculated using the MIT Diffuse-Layer Model (See Part 1, Section 5.4.1.5).

Table 5.3.8-1
Inflow, Outflow, and Residual Loads of Cadmium, Lead, and Zinc for Coeur d'Alene Lake During Water Years 1992-97 and 1999

Constituent and Year	Annual Mean Discharge (cfs)	Whole-Water Recoverable Load (kg/yr)				Dissolved Load (kg/yr)			
		Inflow	Outflow	Residual[a]	Percent Retained [Residual÷Inflow x 100]	Inflow	Outflow	Residual[a]	Percent Retained [Residual÷Inflow x 100]
Cadmium									
1992	3,460	4,020	1,960	2,060	51	2,370	2,090	280	12
1993	5,330	5,610	3,020	2,590	46	3,120	3,220	-100	-3
1994	2,970	3,810	1,690	2,120	56	2,220	1,800	420	19
1995	6,300	7,230	3,570	3,660	51	3,570	3,810	-240	-7
1996	10,200	14,100	5,790	8,310	59	4,960	6,200	-1,240	-25
1997	10,300	11,000	5,830	5,170	47	4,480	6,240	-1,760	-39
1999	7,530	5,000	2,200	2,800	56	3,900	1,680	2,220	57
Lead									
1992	3,460	62,900	17,600	45,300	72	9,000	3,160	5,840	65
1993	5,330	340,000	37,600	302,000	89	15,900	5,910	9,990	63
1994	2,970	87,800	16,100	71,700	82	8,890	2,640	6,250	70
1995	6,300	472,000	37,000	435,000	92	24,500	7,040	17,500	71
1996	10,200	1,840,000	81,600	1,760,000	96	81,000	13,100	68,000	84
1997	10,300	1,330,000	100,000	1,230,000	92	55,300	13,700	41,600	75
1999	7,530	268,000	23,000	245,000	91	18,300	2,800	15,500	85

Table 5.3.8-1 (Continued)
Inflow, Outflow, and Residual Loads of Cadmium, Lead, and Zinc for Coeur d'Alene Lake During Water Years 1992-97 and 1999

Constituent and Year	Annual Mean Discharge (cfs)	Whole-Water Recoverable Load (kg/yr)				Dissolved Load (kg/yr)			
		Inflow	Outflow	Residual[a]	Percent Retained [Residual÷Inflow x 100]	Inflow	Outflow	Residual[a]	Percent Retained [Residual÷Inflow x 100]
Zinc									
1992	3,460	485,000	321,000	164,000	34	484,000	272,000	212,000	43
1993	5,330	660,000	455,000	205,000	31	631,000	394,000	237,000	38
1994	2,970	458,000	263,000	195,000	43	453,000	225,000	228,000	50
1995	6,300	883,000	578,000	305,000	35	722,000	491,000	231,000	32
1996	10,200	1,860,000	890,000	970,000	52	996,000	767,000	229,000	23
1997	10,300	1,450,000	862,000	588,000	41	901,000	752,000	149,000	17
1999	7,530	716,000	490,000	226,000	32	580,000	480,000	100,000	17

[a]Inflow - outflow

Table 5.3.8-2
Inflow, Outflow, and Residual Loads of Nitrogen and Phosphorus for Coeur d'Alene Lake During Calendar Years 1991-92 and Water Year 1999

Constituent and Year	Annual Mean Discharge[a] (cfs)	Load (kg/yr)			Percent Retained (Residual ÷ Inflow x 100)
		Inflow	Outflow	Residual[b]	
Total Nitrogen					
1991	7,020	2,270,000	2,150,000	120,000	5
1992	3,500	1,020,000	935,000	85,000	8
1999	7,530	857,000	1,100,000	-243,000	-28
Total Phosphorus					
1991	7,020	133,000	54,000	79,000	59
1992	3,500	55,000	39,000	16,000	29
1999	7,530	115,000	85,000	30,000	26
Dissolved Inorganic Nitrogen					
1991	7,020	333,000	391,000	-58,000	-17
1992	3,500	146,000	184,000	-38,000	-26
1999	7,530	232,000	306,000	-74,000	-32
Dissolved Orthophosphorus					
1991	7,020	24,000	14,000	10,000	42
1992	3,500	11,100	11,000	100	1
1999	7,530	16,300	16,800	-500	-3

[a]Measured at USGS station 12419000, Spokane River near Post Falls, Idaho.
[b]Inflow - outflow

Notes:
cfs - cubic feet per second
kg/yr - kilogram per year

Table 5.3.8-8
Summary of Benthic Fluxes of Dissolved Metals and Sulfate in Coeur d'Alene Lake

Sampling Location	Method	Benthic Flux,[a] (microgram per square centimeter per year)								
		Cadmium	Copper	Iron	Mercury	Methyl-Mercury	Manganese	Lead	Zinc	Sulfate
Valhalla[b]	Diffusive flux-peepers	––	-0.22	––	––	––	8.5	0	9.5	7.9
	Diffusive flux-core	––	4.4	––	––	––	853	3.6	451	-26
East Point[b]	Diffusive flux-peepers	––	0.45	––	––	––	73	15	19	-22
	Diffusive flux-core	––	11	––	––	––	1411	15	92	––
Harlow Point[b]	Diffusive flux-peepers	––	0.6	––	––	––	104	6	4.8	-2.9
	Diffusive flux-core	––	1	––	––	––	113	26	92	––
Delta[b]	Diffusive flux-peeper	––	-0.06	––	––	––	17	87	23	-3.2
	Diffusive flux-core	––	-0.06	––	––	––	209	3.6	55	-19
Chatcolet[b]	Diffusive flux-peepers	––	-0.05	––	––	––	-2.5	0	0	––
	Diffusive flux-core	––	3.3	––	––	––	179	0	106	––
Main-channel[c]	In situ flux chamber	3.1	1.1	175	––	––	3683	2.4	281	––
	Aerated core incubation	1.1	1.4	-10	0.17	0.0006	7444	20.3	-145	––
	Purged core incubation	3.1	2.6	-79	0.34	0.0013	3924	-0.4	-457	––
Mica Bay[c]	In situ flux chamber	2.3	1.9	114	––	––	3048	1.9	347	––
	Aerated core incubation	-2.9	0.5	16	0.11	0.0003	8182	19.7	-89	––
	Purged core incubation	-3.5	0.5	6.8	0.07	0.0012	8228	9	-390	––

[a]Average flux values were determined for multiple samplings of peepers, flux chambers, and core incubations at each site.
[b]Data from Balistrieri (1998).
[c]Data from Kuwabara et al. (2000)
Negative values indicate the constituent moved into lakebed sediments.

Note: -- - no data

Table 5.3.8-9
Summary of Benthic Fluxes of Nutrients and Dissolved Organic Carbon in Coeur d'Alene Lake

Station	Method	Benthic Flux[a] (microgram per square centimeter per year)				
		PO_4	$NO_3 + NO_2$	NH_3	Total N[b]	Dissolved Organic Carbon
Main-channel[c]	In situ flux chamber	7.2	159	58	217	1942
	Aerated core incubation	91	142	383	526	––
	Purged core incubation	144	58	209	267	––
Mica Bay[c]	In situ flux chamber	22	210	106	316	399
	Aerated core incubation	46	229	744	973	––
	Purged core incubation	147	-368	709	342	––

[a]Average flux values were determined for multiple samplings of flux chambers and core incubations at each site
[b]Sum of dissolved NO_2 + NO_3 and dissolved NH_3
[c]Data from Kuwabara et al. (2000)

Note:
-- - no data

Table 5.3.8-10
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on June 2-3, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (µg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
472730116475900	CdA Lake at mouth of CdA River	19990602 1140	1.3	0.71	0.64	30.6	**4.5**	96.2	**96.6**
472235116450200	St. Joe River at mouth	19990602 1310	3	0.07	0.07	0.18	0.02	2.84	2.71
474030116480600	CdA Lake at outlet to Spokane River	19990603 1315	2	0.36	0.25	10.5	**1.16**	62.3	**54.4**
472500116450000	CdA Lake, C5-Blue Point	19990602 1400	5	0.09	0.07	2.91	0.38	11.9	10
		19990602 1415	15	0.20	0.17	2.36	0.37	42.1	**41.8**
473054116500600	CdA Lake, C4-University Point	19990602 1450	5	0.30	0.27	11.8	**1.56**	44.2	**42.5**
		19990602 1500	35	0.44	0.43	6.07	**0.74**	85.6	**88.3**
473500116482000	CdA Lake, C3-Driftwood Point	19990603 0920	5	0.33	0.28	13.1	**1.3**	50.1	**49.5**
		19990603 0930	50	0.39	0.38	3.9	0.58	82.7	**86**

Table 5.3.8-10 (Continued)
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on June 2-3, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (μg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
473900116453000	CdA Lake, C1-Tubb's Hill	19990603 1120	5	0.33	0.29	10.6	**1.26**	54.3	**53.3**
		19990603 1130	45	0.40	0.38	3.71	0.53	84	**90.1**
47373011641000	CdA Lake, C2-Wolf Lodge Bay	19990603 1220	5	0.29	0.27	2.8	0.54	58.4	**54.1**
		19990603 1230	32	0.34	0.31	2.3	0.37	76.6	**78.3**

Notes:
Bold values exceed applicable screening levels.
CdA - Coeur d'Alene
m - meter
μg/L - microgram per liter
USGS - U.S. Geological Survey
WWR - whole-water recoverable

Table 5.3.8-11
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on July 29-30, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (μg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
472500116450000	CdA Lake, C5-Blue Point	19990729 1030	0-9	0.19	0.15	1.91	0.21	36.8	27.8
		19990729 1045	14	0.26	0.20	2.45	0.16	53.6	**48.1**
473054116500600	CdA Lake, C4-University Point	19990729 1330	0-12	0.26	0.20	2.48	0.16	53.2	**48.5**
		19990729 1350	20	0.32	0.26	2.62	0.35	63.8	**63**
		19990729 1415	38	0.34	0.38	2.49	0.41	86.6	**86.7**
473500116482000	CdA Lake, C3-Driftwood Point	19990730 0800	0-12	0.25	0.24	1.45	0.25	45.7	**41.8**
		19990730 0815	30	0.43	0.35	2.2	0.40	80.6	**82.5**
		19990730 0830	58	0.47	0.42	2.38	0.49	88.1	**89.6**

Notes:
Bold values exceed applicable screening levels.
CdA - Coeur d'Alene
m - meter
WWR - whole-water recoverable
μg/L - microgram per liter
USGS - U.S. Geological Survey

Table 5.3.8-12
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on August 30-31, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (µg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
472500116450000	CdA Lake, C5-Blue Point	19990830 1200	0-13	0.21	0.19	1.04	0.34	39.9	**40**
		19990830 1220	16	0.23	0.20	0.77	0.13	60.1	**62.9**
473054116500600	CdA Lake, C4-University Point	19990830 1500	0-14	0.25	0.22	0.85	0.16	53.3	**54.8**
		19990830 1520	20	0.31	0.25	1.64	0.21	66.9	**69.9**
		19990930 1545	38	0.40	0.36	1.81	0.46	83.7	**88.9**
473500116482000	CdA Lake, C3-Driftwood Point	19990831 0900	0-15	0.22	0.22	0.45	0.12	40.5	**42.1**
		19990831 0930	25	0.73	0.28	1.71	0.20	87.5	**73.0**
		19990831 1000	48	0.33	0.64	1.15	0.43	70.3	**93.5**

Notes:
Bold values exceed applicable screening levels.
CdA - Coeur d'Alene
m - meter
WWR - whole-water recoverable
µg/L - microgram per liter
USGS - U.S. Geological Survey

Table 5.3.8-13
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on September 21, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (µg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
472500116450000	CdA Lake, C5-Blue Point	19990921 1330	0-11	0.21	0.18	0.74	0.20	41.9	**39.7**
		19990921 1345	16	0.30	0.26	1.32	0.19	64.2	**64.0**
473054116500600	CdA Lake, C4-University Point	19990921 1115	0-14	0.25	0.26	0.44	0.10	47.2	**47.4**
		19990921 1130	20	0.29	0.27	1.41	0.14	72.2	**73.9**
		19990921 1145	38	0.40	0.38	1.45	0.35	89.2	**93.6**
473500116482000	CdA Lake, C3-Driftwood Point	19990921 0930	0-14	0.28	0.27	0.35	0.09	47.0	**47.4**
		19990921 0945	30	0.34	0.35	0.95	0.20	78.6	**81.9**
		19990921 1000	58	0.48	0.40	1.47	0.3	93.2	**95.7**

Notes:
Bold values exceed applicable screening levels.
CdA - Coeur d'Alene
m - meter
WWR - whole-water recoverable
µg/L - microgram per liter
USGS - U.S. Geological Survey

Table 5.3.8-14
Concentrations of Cadmium, Lead, and Zinc Measured in Coeur d'Alene Lake on October 19, 1999

USGS Station Number	Station Name	Sample Date and Time	Depth (m)	Trace-element Concentration (µg/L)					
				Cadmium		Lead		Zinc	
				WWR	Dissolved	WWR	Dissolved	WWR	Dissolved
472500116450000	CdA Lake, C5-Blue Point	19991019 1320	0-8	0.17	0.12	0.86	0.12	36.8	**36.1**
		19991019 1400	15	0.12	0.08	0.85	0.11	26.2	**24.6**
473054116500600	CdA Lake, C4-University Point	19991019 1110	0-14	0.26	0.24	0.63	0.18	51.5	**57.1**
		19991019 1120	20	0.31	0.26	0.80	0.16	54.4	**59**
		19991019 1130	38	0.39	0.37	1.06	0.26	90.6	**95.8**
473500116482000	CdA Lake, C3-Driftwood Point	19991019 0915	0-14	0.24	0.21	0.35	0.11	49.0	**53.2**
		19991019 0930	30	0.37	0.34	0.80	0.21	76.3	**84.2**
		19991019 0945	55	0.45	0.38	1	0.25	89.1	**95.6**

Notes:
Bold values exceed applicable screening levels.
CdA - Coeur d'Alene
m - meter
WWR - whole-water recoverable
µg/L - microgram per liter
USGS - U.S. Geological Survey

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ATTACHMENT 1

Statistical Summary of Metals Concentrations by Source Type

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Dissolved Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	>10x SL	>100x SL
Big Creek													
Cadmium	5	1.15	1.64E-08	0	0%	0	0	0	0	0.38	0	0	0
Copper	5	5.6	0.639	1	20%	12	12	12	0	3.2	1	0	0
Iron	5	3.14	0.919	1	20%	8.3	8.3	8.3	0	1000	0	0	0
Manganese	5	2.04	1.09	2	40%	1.2	6	3.6	0.943	20.4	0	0	0
Zinc	5	1.25	0	0	0%	0	0	0	0	42	0	0	0
Canyon Creek													
Antimony	24	3.31	0.585	23	96%	0.63	6.6	3.45	0.541	2.92	13	0	0
Arsenic	25	0.519	0.633	12	48%	0.21	1.4	0.529	0.742	150	0	0	0
Cadmium	161	8.84	3.52	156	97%	0.25	390	9.1	3.47	0.38	154	84	2
Copper	27	1.86	1.05	9	33%	0.34	10	2.23	1.4	3.2	2	0	0
Iron	28	76	1.37	20	71%	4.2	369	100	1.14	1000	0	0	0
Lead	158	32.3	3.89	149	94%	1.5	1480	34.2	3.77	1.09	149	84	2
Manganese	29	190	3.72	26	90%	0.41	3850	211	3.52	20.4	22	3	1
Mercury	24	0.0938	0.18	0	0%	0	0	0	0	0.77	0	0	0
Silver	24	1.05	1.13	0	0%	0	0	0	0	0.43	0	0	0
Zinc	161	930	1.05	160	99%	29.3	4760	935	1.04	42	155	97	1

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Dissolved Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	>10x SL	>100x SL
Nine Mile Creek													
Antimony	18	0.449	0.581	3	17%	0.26	1	0.64	0.579	2.92	0	0	0
Arsenic	18	0.654	0.743	5	28%	0.2	1.9	1.12	0.617	150	0	0	0
Cadmium	18	32.6	0.974	15	83%	0.056	93.7	39.2	0.788	0.38	13	12	9
Copper	18	2.84	1.22	8	44%	0.22	12	4.01	1.24	3.2	3	0	0
Iron	18	95	2.45	6	33%	56.3	1010	250	1.5	1000	1	0	0
Lead	18	45.9	0.915	15	83%	0.14	110	55	0.728	1.09	12	11	1
Manganese	18	156	1.54	16	89%	5.04	1020	176	1.41	20.4	11	5	0
Mercury	18	0.0978	0.0661	0	0%	0	0	0	0	0.77	0	0	0
Silver	17	1.48	0.846	0	0%	0	0	0	0	0.43	0	0	0
Zinc	18	6390	0.923	18	100%	3.9	17300	6390	0.923	42	14	12	10
Pine Creek													
Antimony	12	0.817	0.829	8	67%	0.52	2.1	1.12	0.556	2.92	0	0	0
Arsenic	22	1.59	0.744	14	64%	0.1	4.52	1.64	0.858	150	0	0	0
Cadmium	34	12.6	3.1	29	85%	0.096	187	14.8	2.85	0.38	26	6	3
Copper	22	8.03	3.55	12	55%	0.26	135	14.2	2.7	3.2	4	1	0
Iron	23	729	3.49	13	57%	4.1	11700	1280	2.6	1000	2	1	0
Lead	33	70	5.34	19	58%	0.12	2150	121	4.07	1.09	15	6	1
Manganese	24	249	2.22	21	88%	0.7	2590	284	2.05	20.4	14	6	1
Mercury	16	0.1	1.36E-08	0	0%	0	0	0	0	0.77	0	0	0
Silver	11	0.0595	1.06	0	0%	0	0	0	0	0.43	0	0	0
Zinc	34	3450	3.3	33	97%	37.2	62300	3550	3.25	42	30	12	4

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Dissolved Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	>10x SL	>100x SL
South Fork													
Antimony	9	3.31	0.545	9	100%	1	6.39	3.31	0.545	2.92	4	0	0
Arsenic	9	0.691	0.399	6	67%	0.42	1.1	0.62	0.428	150	0	0	0
Cadmium	20	3.78	1.09	13	65%	0.087	12	5.7	0.686	0.38	12	7	0
Copper	14	2.12	0.738	6	43%	0.52	1.3	0.935	0.332	3.2	0	0	0
Iron	14	236	2.3	8	57%	17	1900	410	1.67	1000	1	0	0
Lead	15	5.77	1.33	10	67%	0.1	20.8	8.29	1.01	1.09	7	3	0
Manganese	14	165	2	9	64%	12.7	1100	256	1.52	20.4	6	3	0
Mercury	9	0.1	2.48E-08	0	0%	0	0	0	0	0.77	0	0	0
Silver	9	0.0489	1.08	0	0%	0	0	0	0	0.43	0	0	0
Zinc	20	435	1.28	15	75%	3.6	1900	578	1	42	10	7	0
Upper South Fork													
Antimony	3	0.653	0.739	2	67%	0.87	0.99	0.93	0.0912	2.92	0	0	0
Arsenic	3	8.63	1.49	2	67%	1.4	23.5	12.5	1.26	150	0	0	0
Cadmium	12	2.07	0.729	6	50%	0.13	5	2.99	0.577	0.38	5	2	0
Copper	12	29.5	2.47	7	58%	0.93	260	48.4	1.93	3.2	6	1	0
Iron	12	10.1	1.42	4	33%	8	50	23.8	0.798	1000	0	0	0
Lead	3	0.503	1.03	3	100%	0.2	1.1	0.503	1.03	1.09	1	0	0
Manganese	12	46.8	2.16	9	75%	1.2	270	61.9	1.84	20.4	2	2	0
Mercury	3	0.1	0	0	0%	0	0	0	0	0.77	0	0	0
Silver	3	0.0883	0.773	0	0%	0	0	0	0	0.43	0	0	0
Zinc	12	85.7	2.73	4	33%	3.9	808	255	1.49	42	2	1	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Dissolved Metals Concentrations

	ALL SAMPLES			DETECTS ONLY							Exceedances		
Analyte	No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	>1x SL	>10x SL	>100x SL
Basin-Wide Summary													
Antimony	66	1.96	0.985	45	68%	0.26	6.6	2.71	0.706	2.92	17	0	0
Arsenic	77	1.19	2.27	39	51%	0.1	23.5	1.63	2.29	150	0	0	0
Cadmium	250	10.2	3.01	219	88%	0.056	390	11.5	2.82	0.38	210	111	14
Copper	98	7.04	4.17	43	44%	0.22	260	13.5	3.24	3.2	16	2	0
Iron	100	240	5.21	52	52%	4.1	11700	454	3.78	1000	4	1	0
Lead	227	36.7	4.81	196	86%	0.1	2150	42.4	4.47	1.09	184	104	4
Manganese	102	168	2.9	83	81%	0.41	3850	207	2.58	20.4	55	19	2
Mercury	70	0.0973	0.109	0	0%	0	0	0	0	0.77	0	0	0
Silver	64	0.81	1.39	0	0%	0	0	0	0	0.43	0	0	0
Zinc	250	1570	3.05	230	92%	3.6	62300	1700	2.92	42	211	129	15

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Total Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (ug/l)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Big Creek													
Arsenic	5	17	0.329	1	20%	27	27	27	0	50	0	0	0
Cadmium	5	4.3	0.399	4	80%	4	6	5	0.163	2	4	0	0
Copper	5	17.5	0	0	0%	0	0	0	0	1	0	0	0
Iron	5	286	1.38	2	40%	580	830	705	0.251	300	2	0	0
Lead	5	7.5	1.42E-08	0	0%	0	0	0	0	15	0	0	0
Manganese	5	160	2.17	5	100%	3	780	160	2.17	50	1	1	0
Mercury	5	2.5	0	0	0%	0	0	0	0	2	0	0	0
Zinc	5	2	0.559	1	20%	4	4	4	0	30	0	0	0
Canyon Creek													
Antimony	28	5.01	1.08	24	86%	0.66	8.2	3.93	0.577	6	5	0	0
Arsenic	29	2.57	2.14	13	45%	0.23	2.4	1.02	0.638	50	0	0	0
Cadmium	272	7.36	3.34	246	90%	0.25	396	8.02	3.22	2	192	12	1
Copper	32	2.78	1.46	10	31%	0.21	6.1	2.02	1.01	1	5	0	0
Iron	28	320	2.14	23	82%	6.8	3700	382	1.94	300	7	1	0
Lead	219	103	3.08	213	97%	0.082	2920	106	3.04	15	158	19	4
Manganese	32	113	1.5	29	91%	8.11	716	125	1.4	50	17	2	0
Mercury	31	0.172	2.53	2	6%	0.17	0.2	0.185	0.115	2	0	0	0
Silver	30	1.05	1.05	1	3%	0.61	0.61	0.61	0	100	0	0	0
Zinc	271	906	2.48	270	100%	31.2	35400	909	2.47	30	270	203	5

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Total Metals Concentrations

	ALL SAMPLES			DETECTS ONLY									
											Exceedances		
Analyte	No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	>1x SL	>10x SL	>100x SL
Nine Mile Creek													
Antimony	19	0.572	1.02	3	16%	0.29	1.3	0.897	0.596	6	0	0	0
Arsenic	19	0.856	0.792	7	37%	0.13	2.3	1.17	0.616	50	0	0	0
Cadmium	19	30.9	0.999	17	89%	0.12	92.3	34.5	0.888	2	13	10	0
Copper	19	4.48	1.31	11	58%	1	23.8	6.69	1.03	1	10	2	0
Iron	18	245	2.45	13	72%	40.8	2550	331	2.1	300	2	0	0
Lead	19	77.3	0.891	19	100%	0.15	243	77.3	0.891	15	13	1	0
Manganese	19	152	1.55	18	95%	5.3	1020	160	1.49	50	10	1	0
Mercury	19	0.0874	0.238	0	0%	0	0	0	0	2	0	0	0
Silver	18	1.45	0.835	1	6%	0.043	0.043	0.043	0	100	0	0	0
Zinc	15	4680	1.18	14	93%	19	18000	5010	1.11	30	13	9	6
Pine Creek													
Antimony	25	0.736	1.12	5	20%	0.76	3.9	1.95	0.634	6	0	0	0
Arsenic	26	1.94	0.964	16	62%	0.3	8.1	2.56	0.852	50	0	0	0
Cadmium	37	12.4	3.28	31	84%	0.17	190	14.7	2.99	2	13	2	0
Copper	27	16	2.82	17	63%	0.21	191	25.1	2.21	1	14	5	2
Iron	27	1480	3.13	20	74%	5.6	23100	1990	2.67	300	8	3	0
Lead	38	78.3	4.46	27	71%	0.83	2160	110	3.77	15	9	3	1
Manganese	27	210	2.49	21	78%	0.6	2610	270	2.15	50	11	4	0
Mercury	26	0.0846	0.278	0	0%	0	0	0	0	2	0	0	0
Silver	24	0.6	3.59	2	8%	0.22	10.7	5.46	1.36	100	0	0	0
Zinc	38	2540	3.91	37	97%	21.2	61400	2610	3.86	30	36	14	5

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Total Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	>10x SL	>100x SL
South Fork													
Antimony	10	3.86	0.524	10	100%	1.1	7	3.86	0.524	6	2	0	0
Arsenic	15	4.82	1.28	7	47%	0.42	4.9	1.33	1.21	50	0	0	0
Cadmium	39	6.22	0.648	33	85%	0.1	16	7.26	0.474	2	31	0	0
Copper	15	9.82	1.32	10	67%	0.3	38	9.08	1.66	1	9	2	0
Iron	14	1240	1.72	9	64%	35	5900	1920	1.26	300	5	2	0
Lead	39	42.4	1.25	34	87%	0.2	227	48	1.14	15	27	3	0
Manganese	15	195	1.75	12	80%	5	1200	244	1.52	50	6	2	0
Mercury	15	0.906	1.29	0	0%	0	0	0	0	2	0	0	0
Silver	10	0.151	0.817	0	0%	0	0	0	0	100	0	0	0
Zinc	39	841	0.801	32	82%	14	2700	1020	0.59	30	29	28	0
Upper South Fork													
Antimony	4	5.99	1.84	1	25%	0.94	0.94	0.94	0	6	0	0	0
Arsenic	13	13.1	0.512	3	23%	1.5	25.2	11	1.14	50	0	0	0
Cadmium	118	3.1	0.801	72	61%	0.4	8	4.44	0.527	2	55	0	0
Copper	14	34.7	2.31	3	21%	3.2	310	119	1.4	1	3	2	1
Iron	12	96.7	2.29	3	25%	98	770	363	0.987	300	1	0	0
Lead	118	73.3	0.527	110	93%	0.9	306	78	0.456	15	103	2	0
Manganese	14	357	2.17	11	79%	4	2660	453	1.88	50	4	2	0
Mercury	14	1.66	0.712	1	7%	0.32	0.32	0.32	0	2	0	0	0
Silver	5	0.572	1.43	0	0%	0	0	0	0	100	0	0	0
Zinc	116	186	0.726	107	92%	10	851	202	0.642	30	105	11	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Adit and Seep Drainage - Total Metals Concentrations

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (ug/l)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (ug/l)	Max. Value (ug/l)	Avg. Value (ug/l)	Coefficient of Variation	Screening Value (ug/l)	Exceedances >1x SL	>10x SL	>100x SL
Basin-Wide Summary													
Antimony	86	2.7	1.61	43	50%	0.29	8.2	3.4	0.651	6	7	0	0
Arsenic	107	4.38	1.47	47	44%	0.13	27	2.8	1.88	50	0	0	0
Cadmium	490	7.5	3.05	403	82%	0.1	396	8.92	2.8	2	308	24	1
Copper	112	11.9	3.12	51	46%	0.21	310	19	2.82	1	41	11	3
Iron	104	704	3.62	70	67%	5.6	23100	1040	2.94	300	25	6	0
Lead	438	85.4	2.92	403	92%	0.082	2920	92.3	2.8	15	310	28	5
Manganese	112	187	2.25	96	86%	0.6	2660	217	2.05	50	49	12	0
Mercury	110	0.531	1.76	3	3%	0.17	0.32	0.23	0.345	2	0	0	0
Silver	87	0.878	1.67	4	5%	0.043	10.7	2.89	1.8	100	0	0	0
Zinc	484	964	3.6	461	95%	4	61400	1010	3.51	30	453	265	16

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Big Creek													
Antimony	1	623	0	1	100%	623	623	623	0	3.3	1	1	1
Arsenic	1	22	0	1	100%	22	22	22	0	13.6	1	0	0
Cadmium	1	9.11	0	1	100%	9.11	9.11	9.11	0	1.56	1	0	0
Copper	1	70.8	0	1	100%	70.8	70.8	70.8	0	32.3	1	0	0
Iron	1	39900	0	1	100%	39900	39900	39900	0	40000	0	0	0
Lead	1	1900	0	1	100%	1900	1900	1900	0	51.5	1	1	0
Manganese	1	3060	0	1	100%	3060	3060	3060	0	1210	1	0	0
Mercury	1	0.54	0	1	100%	0.54	0.54	0.54	0	0.179	1	0	0
Silver	1	8.42	0	1	100%	8.42	8.42	8.42	0	4.5	1	0	0
Zinc	1	1470	0	1	100%	1470	1470	1470	0	200	1	0	0
Canyon Creek													
Antimony	44	30.5	2.03	28	64%	0.84	288	46.1	1.59	3.3	22	8	0
Arsenic	61	20.6	1.51	61	100%	1.4	215	20.6	1.51	13.6	23	1	0
Cadmium	106	16.8	1.97	98	92%	0.0308	186	18.2	1.88	1.56	83	26	2
Copper	77	124	1.68	77	100%	6.9	1500	124	1.68	32.3	44	6	0
Iron	110	37900	1.93	110	100%	1980	547000	37900	1.93	40000	22	2	0
Lead	107	5950	2.02	107	100%	4.11	74500	5950	2.02	51.5	92	71	30
Manganese	60	1310	1.19	60	100%	101	10100	1310	1.19	1210	17	0	0
Mercury	54	2.07	2.07	35	65%	0.07	24	3.18	1.57	0.179	28	16	1
Silver	54	13.4	2.06	31	57%	0.22	126	23.2	1.44	4.5	23	4	0
Zinc	108	4440	2.81	108	100%	32.9	110000	4440	2.81	200	89	28	10

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Lower Coeur d'Alene River													
Antimony	86	31.2	0.824	81	94%	1.6	129	33.1	0.764	3	65	47	0
Arsenic	88	157	1.15	88	100%	2	990	157	1.15	12.6	65	41	0
Cadmium	117	16.4	1.09	111	95%	0.916	158	17.3	1.04	0.678	111	87	2
Copper	104	92.4	0.649	104	100%	7	270	92.4	0.649	28	79	0	0
Iron	116	68800	0.67	116	100%	2.16	192000	68800	0.67	40000	79	0	0
Lead	117	2640	0.876	117	100%	11.5	12900	2640	0.876	47.3	96	91	10
Manganese	88	4360	0.809	88	100%	64	15800	4360	0.809	630	66	32	0
Mercury	83	2.39	1.12	63	76%	0.02	13	3.13	0.848	0.179	58	44	0
Silver	85	10.1	0.827	65	76%	0.287	36.8	13.2	0.537	4.5	60	0	0
Zinc	119	1810	0.921	119	100%	44	12500	1810	0.921	97.1	112	88	1
Main Stem Coeur d'Alene													
Arsenic	2	79.3	0.0838	2	100%	74.6	84	79.3	0.0838	13.6	2	0	0
Cadmium	2	16.4	0.31	2	100%	12.8	20	16.4	0.31	1.56	2	1	0
Copper	2	66	0.122	2	100%	60.3	71.7	66	0.122	32.3	2	0	0
Iron	2	38300	0.0148	2	100%	37900	38700	38300	0.0148	40000	0	0	0
Lead	17	4020	1.37	17	100%	91	17000	4020	1.37	51.5	17	10	5
Manganese	2	3090	0.103	2	100%	2860	3310	3090	0.103	1210	2	0	0
Zinc	2	1390	0.214	2	100%	1180	1600	1390	0.214	200	2	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Nine Mile Creek													
Antimony	22	21.2	2.4	14	64%	1.1	241	32.4	1.91	3.3	13	4	0
Arsenic	25	19.8	1.17	25	100%	1.6	105	19.8	1.17	13.6	9	0	0
Cadmium	34	31	1.89	31	91%	0.945	298	34	1.78	1.56	29	19	2
Copper	32	120	0.699	32	100%	9.5	381	120	0.699	32.3	27	1	0
Iron	34	51700	1.21	34	100%	8770	296000	51700	1.21	40000	11	0	0
Lead	35	7020	1.39	35	100%	20.7	54100	7020	1.39	51.5	33	30	17
Manganese	25	1670	1.04	25	100%	226	6830	1670	1.04	1210	12	0	0
Mercury	22	1.85	1.68	16	73%	0.0587	9.5	2.53	1.35	0.179	13	4	0
Silver	22	9.98	0.982	19	86%	1.68	39.5	11.5	0.836	4.5	14	0	0
Zinc	35	8610	3.23	35	100%	66.6	166000	8610	3.23	200	32	20	2
Pine Creek													
Antimony	62	7.08	1.65	43	69%	0.897	59.7	7.26	1.87	3.3	14	2	0
Arsenic	62	52.7	1.44	62	100%	2.79	347	52.7	1.44	13.6	41	8	0
Cadmium	62	6.22	2.76	55	89%	0.417	122	6.98	2.6	1.56	36	4	0
Copper	61	68.7	1.84	61	100%	9.84	779	68.7	1.84	32.3	26	2	0
Iron	62	23100	0.695	62	100%	8480	103000	23100	0.695	40000	6	0	0
Lead	62	1130	1.56	62	100%	83.9	8260	1130	1.56	51.5	62	31	4
Manganese	62	535	0.546	62	100%	18.6	1340	535	0.546	1210	1	0	0
Mercury	62	0.327	2.16	36	58%	0.0507	4.6	0.536	1.63	0.179	19	2	0
Silver	62	2.31	1.72	54	87%	0.27	26.6	2.57	1.64	4.5	6	0	0
Zinc	62	1360	1.86	62	100%	113	16900	1360	1.86	200	59	8	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

	ALL SAMPLES			DETECTS ONLY							Exceedances		
Analyte	No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	>1x SL	>10x SL	>100x SL
Prichard Creek													
Arsenic	1	170	0	1	100%	170	170	170	0	13.6	1	1	0
Cadmium	1	330	0	1	100%	330	330	330	0	1.56	1	1	1
Copper	1	250	0	1	100%	250	250	250	0	32.3	1	0	0
Iron	1	28000	0	1	100%	28000	28000	28000	0	40000	0	0	0
Lead	1	3000	0	1	100%	3000	3000	3000	0	51.5	1	1	0
Manganese	1	1200	0	1	100%	1200	1200	1200	0	1210	0	0	0
Zinc	1	68000	0	1	100%	68000	68000	68000	0	200	1	1	1
South Fork													
Antimony	101	74.7	1.09	92	91%	0.983	364	81.8	1.01	3.3	90	67	4
Arsenic	127	132	0.806	127	100%	3.81	710	132	0.806	13.6	116	53	0
Cadmium	125	52.1	1.28	125	100%	5	472	52.1	1.28	1.56	125	94	8
Copper	127	205	0.786	127	100%	17	823	205	0.786	32.3	120	27	0
Iron	126	67800	0.619	126	100%	1.79	177000	67800	0.619	40000	88	0	0
Lead	136	9360	1.21	136	100%	20	60600	9360	1.21	51.5	135	131	61
Manganese	124	6340	0.597	124	100%	500	20200	6340	0.597	1210	121	11	0
Mercury	93	5.99	1.15	93	100%	0.02	25.1	5.99	1.15	0.179	84	66	13
Silver	99	25.6	1.3	97	98%	0.6	171	26.2	1.28	4.5	86	16	0
Zinc	127	5710	1.2	127	100%	44	51000	5710	1.2	200	126	97	5

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Upper South Fork													
Antimony	7	3.3	1.54	2	29%	0.948	14.7	7.82	1.24	3.3	1	0	0
Arsenic	8	17.6	0.72	7	88%	3.19	28.4	14	0.592	13.6	3	0	0
Cadmium	8	13.1	2.1	8	100%	1.61	81	13.1	2.1	1.56	8	1	0
Copper	8	87.4	0.412	8	100%	34.1	139	87.4	0.412	32.3	8	0	0
Iron	8	37600	0.949	8	100%	6160	121000	37600	0.949	40000	2	0	0
Lead	8	2600	1.75	8	100%	527	13800	2600	1.75	51.5	8	8	1
Manganese	8	3700	1.35	8	100%	391	15700	3700	1.35	1210	6	1	0
Mercury	7	0.742	1.69	7	100%	0.0533	3.55	0.742	1.69	0.179	4	1	0
Silver	7	6.41	1.29	7	100%	0.896	24.9	6.41	1.29	4.5	2	0	0
Zinc	8	2820	1.57	8	100%	305	13700	2820	1.57	200	8	1	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Sediments

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Basin-Wide Summary													
Antimony	86	31.2	0.824	81	94%	1.6	129	33.1	0.764	3	65	47	0
Antimony	237	44	1.77	180	76%	0.84	623	56.8	1.51	3.3	141	82	5
Arsenic	88	157	1.15	88	100%	2	990	157	1.15	12.6	65	41	0
Arsenic	287	77.4	1.22	286	100%	1.4	710	77.5	1.22	13.6	196	63	0
Cadmium	117	16.4	1.09	111	95%	0.916	158	17.3	1.04	0.678	111	87	2
Cadmium	339	30.1	1.82	321	95%	0.0308	472	31.8	1.75	1.56	285	146	13
Copper	104	92.4	0.649	104	100%	7	270	92.4	0.649	28	79	0	0
Copper	309	145	1.16	309	100%	6.9	1500	145	1.16	32.3	229	36	0
Iron	460	52900	1.02	460	100%	1.79	547000	52900	1.02	40000	208	2	0
Lead	117	2640	0.876	117	100%	11.5	12900	2640	0.876	47.3	96	91	10
Lead	367	6320	1.65	367	100%	4.11	74500	6320	1.65	51.5	349	283	118
Manganese	88	4360	0.809	88	100%	64	15800	4360	0.809	630	66	32	0
Manganese	283	3460	1.1	283	100%	18.6	20200	3460	1.1	1210	160	12	0
Mercury	322	2.9	1.68	251	78%	0.02	25.1	3.71	1.41	0.179	207	133	14
Silver	330	13.8	1.71	274	83%	0.22	171	16.5	1.51	4.5	192	20	0
Zinc	119	1810	0.921	119	100%	44	12500	1810	0.921	97.1	112	88	1
Zinc	344	4900	2.58	344	100%	32.9	166000	4900	2.58	200	318	155	18

NOTE: Basin-Wide Summary displays separate summary results by analyte fo
different sediment screening levels in the Upper and Lower Basin.

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Tailings

Analyte	ALL SAMPLES: No. Samples Analyzed	ALL SAMPLES: Avg. Value (mg/kg)	ALL SAMPLES: Coefficient of Variation	DETECTS ONLY: No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances: >1x SL	>10x SL	>100x SL
Beaver Creek													
Arsenic	3	95.3	0.147	3	100%	82	110	95.3	0.147	13.6	3	0	0
Cadmium	3	3.27	0.433	3	100%	2.4	4.9	3.27	0.433	1.56	3	0	0
Copper	3	79.7	0.56	3	100%	45	130	79.7	0.56	32.3	3	0	0
Iron	3	35300	0.201	3	100%	29000	43000	35300	0.201	40000	1	0	0
Lead	3	1670	0.689	3	100%	920	3000	1670	0.689	51.5	3	3	0
Manganese	3	1080	0.306	3	100%	740	1400	1080	0.306	1210	1	0	0
Zinc	3	550	1.02	3	100%	200	1200	550	1.02	200	2	0	0
Canyon Creek													
Antimony	2	28.1	0.406	2	100%	20	36.1	28.1	0.406	3.3	2	1	0
Arsenic	3	12.8	0.82	3	100%	5.8	24.8	12.8	0.82	13.6	1	0	0
Cadmium	3	21	1.55	2	67%	4.3	58.6	31.5	1.22	1.56	2	1	0
Copper	3	126	1.36	3	100%	17.1	323	126	1.36	32.3	2	0	0
Iron	3	16500	0.378	3	100%	12200	23700	16500	0.378	40000	0	0	0
Lead	3	7270	1.55	3	100%	26.4	20200	7270	1.55	51.5	2	2	1
Manganese	3	1530	1.08	3	100%	564	3450	1530	1.08	1210	1	0	0
Mercury	3	1.85	1.57	2	67%	0.31	5.2	2.76	1.26	0.179	2	1	0
Silver	3	18.6	1.49	2	67%	5.3	50.3	27.8	1.14	4.5	2	1	0
Zinc	3	3400	1.51	3	100%	93.3	9300	3400	1.51	200	2	1	0
Moon Creek													
Arsenic	1	960	0	1	100%	960	960	960	0	13.6	1	1	0
Cadmium	1	3	0	1	100%	3	3	3	0	1.56	1	0	0
Copper	1	390	0	1	100%	390	390	390	0	32.3	1	1	0
Iron	1	41000	0	1	100%	41000	41000	41000	0	40000	1	0	0
Lead	1	8600	0	1	100%	8600	8600	8600	0	51.5	1	1	1
Manganese	1	140	0	1	100%	140	140	140	0	1210	0	0	0
Zinc	1	1000	0	1	100%	1000	1000	1000	0	200	1	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Tailings

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Pine Creek													
Antimony	18	40.8	2.45	15	83%	3.1	437	47	2.32	3.3	14	3	1
Arsenic	18	115	1.03	18	100%	17.6	523	115	1.03	13.6	18	6	0
Cadmium	18	22.1	1.49	13	72%	6.6	122	30.5	1.16	1.56	13	5	0
Copper	18	211	1.66	17	94%	22.6	1430	224	1.6	32.3	16	2	0
Iron	18	42100	0.784	18	100%	7960	128000	42100	0.784	40000	7	0	0
Lead	18	3930	0.63	18	100%	776	8260	3930	0.63	51.5	18	18	4
Manganese	18	1160	1.73	18	100%	16.1	8990	1160	1.73	1210	4	0	0
Mercury	18	1.74	0.863	17	94%	0.23	4.6	1.83	0.813	0.179	17	7	0
Silver	18	8.92	1.38	18	100%	0.76	56.1	8.92	1.38	4.5	11	1	0
Zinc	18	4670	1.1	18	100%	408	16900	4670	1.1	200	18	12	0
Basin-Wide Summary													
Antimony	20	39.5	2.4	17	85%	3.1	437	44.8	2.28	3.3	16	4	1
Arsenic	25	134	1.5	25	100%	5.8	960	134	1.5	13.6	23	7	0
Cadmium	25	18.9	1.58	19	76%	2.4	122	24.9	1.3	1.56	19	6	0
Copper	25	193	1.59	24	96%	17.1	1430	201	1.55	32.3	22	3	0
Iron	25	38200	0.764	25	100%	7960	128000	38200	0.764	40000	9	0	0
Lead	25	4250	0.993	25	100%	26.4	20200	4250	0.993	51.5	24	24	6
Manganese	25	1160	1.54	25	100%	16.1	8990	1160	1.54	1210	6	0	0
Mercury	21	1.75	0.947	19	90%	0.23	5.2	1.93	0.854	0.179	19	8	0
Silver	21	10.3	1.43	20	95%	0.76	56.1	10.8	1.38	4.5	13	2	0
Zinc	25	3880	1.24	25	100%	93.3	16900	3880	1.24	200	23	13	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Beaver Creek													
Arsenic	1	99	0	1	100%	99	99	99	0	13.6	1	0	0
Cadmium	1	3.5	0	1	100%	3.5	3.5	3.5	0	1.56	1	0	0
Copper	1	59	0	1	100%	59	59	59	0	32.3	1	0	0
Iron	1	49000	0	1	100%	49000	49000	49000	0	40000	1	0	0
Lead	1	630	0	1	100%	630	630	630	0	51.5	1	1	0
Manganese	1	1600	0	1	100%	1600	1600	1600	0	1210	1	0	0
Zinc	1	160	0	1	100%	160	160	160	0	200	0	0	0
Big Creek													
Arsenic	5	84.5	0.858	2	40%	85	210	148	0.599	13.6	2	1	0
Cadmium	5	1.96	0.288	5	100%	1.3	2.7	1.96	0.288	1.56	3	0	0
Copper	5	22	0.64	5	100%	11	45	22	0.64	32.3	1	0	0
Iron	5	20200	0.478	5	100%	8200	35000	20200	0.478	40000	0	0	0
Lead	5	46.4	0.906	5	100%	18	120	46.4	0.906	51.5	1	0	0
Manganese	5	1080	0.9	5	100%	120	2700	1080	0.9	1210	1	0	0
Zinc	5	83.8	1.23	5	100%	7	250	83.8	1.23	200	1	0	0
Moon Creek													
Arsenic	1	410	0	1	100%	410	410	410	0	13.6	1	1	0
Cadmium	1	13	0	1	100%	13	13	13	0	1.56	1	0	0
Copper	1	87	0	1	100%	87	87	87	0	32.3	1	0	0
Iron	1	44000	0	1	100%	44000	44000	44000	0	40000	1	0	0
Lead	1	1200	0	1	100%	1200	1200	1200	0	51.5	1	1	0
Manganese	1	830	0	1	100%	830	830	830	0	1210	0	0	0
Zinc	1	1100	0	1	100%	1100	1100	1100	0	200	1	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Nine Mile Creek													
Antimony	1	2.8	0	1	100%	2.8	2.8	2.8	0	3.3	0	0	0
Arsenic	1	10	0	1	100%	10	10	10	0	13.6	0	0	0
Cadmium	1	16.4	0	1	100%	16.4	16.4	16.4	0	1.56	1	1	0
Copper	1	81.1	0	1	100%	81.1	81.1	81.1	0	32.3	1	0	0
Iron	1	27900	0	1	100%	27900	27900	27900	0	40000	0	0	0
Lead	1	3230	0	1	100%	3230	3230	3230	0	51.5	1	1	0
Manganese	1	798	0	1	100%	798	798	798	0	1210	0	0	0
Mercury	1	2.2	0	1	100%	2.2	2.2	2.2	0	0.179	1	1	0
Silver	1	5.3	0	1	100%	5.3	5.3	5.3	0	4.5	1	0	0
Zinc	1	3160	0	1	100%	3160	3160	3160	0	200	1	1	0
Prichard Creek													
Arsenic	4	988	1.11	4	100%	110	2400	988	1.11	13.6	4	3	1
Cadmium	4	14.7	0.643	4	100%	2.9	26	14.7	0.643	1.56	4	2	0
Copper	4	268	1.24	4	100%	45	760	268	1.24	32.3	4	1	0
Iron	4	60300	0.467	4	100%	33000	91000	60300	0.467	40000	2	0	0
Lead	4	3320	1.1	4	100%	120	8100	3320	1.1	51.5	4	3	1
Manganese	4	843	0.366	4	100%	580	1200	843	0.366	1210	0	0	0
Zinc	4	2910	0.934	4	100%	140	6500	2910	0.934	200	3	2	0
Upper South Fork													
Arsenic	3	56.7	0.433	1	33%	85	85	85	0	13.6	1	0	0
Cadmium	3	5.03	0.74	3	100%	0.78	7.7	5.03	0.74	1.56	2	0	0
Copper	3	1140	0.798	3	100%	130	1900	1140	0.798	32.3	3	2	0
Iron	3	71100	1.45	3	100%	4400	190000	71100	1.45	40000	1	0	0
Lead	3	603	1.29	3	100%	150	1500	603	1.29	51.5	3	1	0
Manganese	3	3410	1.05	3	100%	930	7500	3410	1.05	1210	2	0	0
Zinc	3	604	1.57	3	100%	15	1700	604	1.57	200	1	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Floodplain Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	DETECTS ONLY % of Samples	DETECTS ONLY Min. Value (mg/kg)	DETECTS ONLY Max. Value (mg/kg)	DETECTS ONLY Avg. Value (mg/kg)	DETECTS ONLY Coefficient of Variation	DETECTS ONLY Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Basin-Wide Summary													
Antimony	1	2.8	0	1	100%	2.8	2.8	2.8	0	3.3	0	0	0
Arsenic	15	337	1.94	10	67%	10	2400	485	1.59	13.6	9	5	1
Cadmium	15	7.78	0.974	15	100%	0.78	26	7.78	0.974	1.56	12	3	0
Copper	15	323	1.79	15	100%	11	1900	323	1.79	32.3	11	3	0
Iron	15	45100	1.03	15	100%	4400	190000	45100	1.03	40000	5	0	0
Lead	15	1360	1.66	15	100%	18	8100	1360	1.66	51.5	11	7	1
Manganese	15	1480	1.2	15	100%	120	7500	1480	1.2	1210	4	0	0
Mercury	1	2.2	0	1	100%	2.2	2.2	2.2	0	0.179	1	1	0
Silver	1	5.3	0	1	100%	5.3	5.3	5.3	0	4.5	1	0	0
Zinc	15	1220	1.52	15	100%	7	6500	1220	1.52	200	7	3	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Concentrates and Process Wastes

	ALL SAMPLES			DETECTS ONLY							Exceedances		
Analyte	No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	>1x SL	>10x SL	>100x SL
Prichard Creek													
Arsenic	3	140	0.247	3	100%	100	160	140	0.247	22	3	0	0
Cadmium	3	213	0.222	3	100%	160	250	213	0.222	9.8	3	3	0
Copper	3	603	0.463	3	100%	300	850	603	0.463	100	3	0	0
Iron	3	24300	0.335	3	100%	15000	30000	24300	0.335	65000	0	0	0
Lead	3	18500	1.01	3	100%	7100	40000	18500	1.01	171	3	3	1
Manganese	3	1030	0.308	3	100%	680	1300	1030	0.308	3597	0	0	0
Zinc	3	53700	0.205	3	100%	43000	65000	53700	0.205	280	3	3	3
Basin-Wide Summary													
Arsenic	3	140	0.247	3	100%	100	160	140	0.247	22	3	0	0
Cadmium	3	213	0.222	3	100%	160	250	213	0.222	9.8	3	3	0
Copper	3	603	0.463	3	100%	300	850	603	0.463	100	3	0	0
Iron	3	24300	0.335	3	100%	15000	30000	24300	0.335	65000	0	0	0
Lead	3	18500	1.01	3	100%	7100	40000	18500	1.01	171	3	3	1
Manganese	3	1030	0.308	3	100%	680	1300	1030	0.308	3597	0	0	0
Zinc	3	53700	0.205	3	100%	43000	65000	53700	0.205	280	3	3	3

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Tailings

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Canyon Creek													
Antimony	6	54	1.71	6	100%	1.7	239	54	1.71	31.3	2	0	0
Arsenic	6	34.3	1.06	6	100%	5.8	97	34.3	1.06	22	3	0	0
Cadmium	20	23	2.19	20	100%	0.0679	186	23	2.19	9.8	5	2	0
Copper	13	239	1.41	13	100%	5.65	1220	239	1.41	100	6	1	0
Iron	21	41300	0.905	21	100%	2270	154000	41300	0.905	65000	3	0	0
Lead	20	12500	1.36	20	100%	63.4	63700	12500	1.36	171	18	13	5
Manganese	6	1790	0.527	6	100%	882	3020	1790	0.527	3597	0	0	0
Mercury	6	3.52	1.38	6	100%	0.19	13	3.52	1.38	23.5	0	0	0
Silver	6	39.1	1.39	5	83%	0.59	126	46.7	1.22	391	0	0	0
Zinc	19	3960	2.2	19	100%	43.5	30000	3960	2.2	280	11	4	1
Nine Mile Creek													
Antimony	18	30.5	3.56	10	56%	1.8	466	50.9	2.87	31.3	1	1	0
Arsenic	18	28.7	1.26	16	89%	1.1	148	32.2	1.14	22	8	0	0
Cadmium	32	27.6	2.26	29	91%	0.45	298	30.5	2.14	9.8	16	2	0
Copper	28	295	2.69	28	100%	9.4	4190	295	2.69	100	14	2	0
Iron	33	47900	0.719	33	100%	10000	129000	47900	0.719	65000	7	0	0
Lead	34	6920	1.53	34	100%	6.5	46600	6920	1.53	171	28	22	4
Manganese	18	1340	0.707	18	100%	310	3210	1340	0.707	3597	0	0	0
Mercury	18	2.77	1.99	14	78%	0.09	21	3.56	1.7	23.5	0	0	0
Silver	18	9.88	1.85	13	72%	2.3	77.7	13.6	1.51	391	0	0	0
Zinc	34	11700	2.97	34	100%	41.1	166000	11700	2.97	280	24	13	2

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Tailings

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	DETECTS ONLY % of Samples	DETECTS ONLY Min. Value (mg/kg)	DETECTS ONLY Max. Value (mg/kg)	DETECTS ONLY Avg. Value (mg/kg)	DETECTS ONLY Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Pine Creek													
Antimony	4	13.8	0.578	0	0%	0	0	0	0	31.3	0	0	0
Arsenic	4	53.5	0.702	4	100%	15.9	89.6	53.5	0.702	22	3	0	0
Cadmium	4	8.1	0.713	3	75%	5.7	14.4	10.4	0.423	9.8	2	0	0
Copper	4	105	1.15	4	100%	32.4	284	105	1.15	100	1	0	0
Iron	4	35500	0.261	4	100%	24100	45800	35500	0.261	65000	0	0	0
Lead	4	923	0.926	4	100%	192	1940	923	0.926	171	4	1	0
Manganese	4	1040	0.353	4	100%	492	1270	1040	0.353	3597	0	0	0
Mercury	4	0.114	0.589	0	0%	0	0	0	0	23.5	0	0	0
Silver	4	1.62	0.816	2	50%	1	3.5	2.25	0.786	391	0	0	0
Zinc	4	1930	0.678	4	100%	388	3580	1930	0.678	280	4	1	0
Basin-Wide Summary													
Antimony	28	33.1	2.89	16	57%	1.7	466	52.1	2.4	31.3	3	1	0
Arsenic	28	33.4	1.08	26	93%	1.1	148	36	1	22	14	0	0
Cadmium	56	24.6	2.27	52	93%	0.0679	298	26.4	2.17	9.8	23	4	0
Copper	45	262	2.47	45	100%	5.65	4190	262	2.47	100	21	3	0
Iron	58	44700	0.768	58	100%	2270	154000	44700	0.768	65000	10	0	0
Lead	58	8420	1.56	58	100%	6.5	63700	8420	1.56	171	50	36	9
Manganese	28	1400	0.642	28	100%	310	3210	1400	0.642	3597	0	0	0
Mercury	28	2.55	1.94	20	71%	0.09	21	3.54	1.58	23.5	0	0	0
Silver	28	15	2.04	20	71%	0.59	126	20.7	1.67	391	0	0	0
Zinc	57	8460	3.25	57	100%	41.1	166000	8460	3.25	280	39	18	3

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Big Creek													
Arsenic	2	71.3	0.571	1	50%	100	100	100	0	22	1	0	0
Cadmium	2	2.8	0.808	2	100%	1.2	4.4	2.8	0.808	9.8	0	0	0
Copper	2	22	0.321	2	100%	17	27	22	0.321	100	0	0	0
Iron	2	15500	0.502	2	100%	10000	21000	15500	0.502	65000	0	0	0
Lead	2	163	1.2	2	100%	25	300	163	1.2	171	1	0	0
Manganese	2	660	0.0857	2	100%	620	700	660	0.0857	3597	0	0	0
Zinc	2	402	1.33	2	100%	24	780	402	1.33	280	1	0	0
Canyon Creek													
Antimony	13	55.7	1.53	13	100%	1.3	242	55.7	1.53	31.3	5	0	0
Arsenic	15	287	3.21	14	93%	5.8	3610	304	3.13	22	10	1	1
Cadmium	59	14.6	2.18	58	98%	0.0255	186	14.8	2.16	9.8	17	2	0
Copper	30	275	1.22	30	100%	5.65	1220	275	1.22	100	16	2	0
Iron	61	47000	1.04	61	100%	2270	225000	47000	1.04	65000	13	0	0
Lead	55	8060	1.67	55	100%	1.78	63700	8060	1.67	171	45	27	10
Manganese	15	1900	0.535	15	100%	560	3450	1900	0.535	3597	0	0	0
Mercury	14	2.74	1.32	12	86%	0.19	13	3.19	1.17	23.5	0	0	0
Silver	14	44	1.38	11	79%	0.59	157	55.8	1.14	391	0	0	0
Zinc	56	2630	2.25	56	100%	1.4	30000	2630	2.25	280	34	9	1
Moon Creek													
Arsenic	2	1500	0.189	2	100%	1300	1700	1500	0.189	22	2	2	0
Cadmium	2	57.5	1.29	2	100%	4.9	110	57.5	1.29	9.8	1	1	0
Copper	2	830	0.971	2	100%	260	1400	830	0.971	100	2	1	0
Iron	2	96000	0.206	2	100%	82000	110000	96000	0.206	65000	2	0	0
Lead	2	5740	1.3	2	100%	480	11000	5740	1.3	171	2	1	0
Manganese	2	91.5	0.286	2	100%	73	110	91.5	0.286	3597	0	0	0
Zinc	2	8120	1.37	2	100%	230	16000	8120	1.37	280	1	1	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
Nine Mile Creek													
Antimony	18	30.5	3.56	10	56%	1.8	466	50.9	2.87	31.3	1	1	0
Arsenic	18	28.7	1.26	16	89%	1.1	148	32.2	1.14	22	8	0	0
Cadmium	32	27.6	2.26	29	91%	0.45	298	30.5	2.14	9.8	16	2	0
Copper	28	295	2.69	28	100%	9.4	4190	295	2.69	100	14	2	0
Iron	33	47900	0.719	33	100%	10000	129000	47900	0.719	65000	7	0	0
Lead	34	6920	1.53	34	100%	6.5	46600	6920	1.53	171	28	22	4
Manganese	18	1340	0.707	18	100%	310	3210	1340	0.707	3597	0	0	0
Mercury	18	2.77	1.99	14	78%	0.09	21	3.56	1.7	23.5	0	0	0
Silver	18	9.88	1.85	13	72%	2.3	77.7	13.6	1.51	391	0	0	0
Zinc	34	11700	2.97	34	100%	41.1	166000	11700	2.97	280	24	13	2
Pine Creek													
Antimony	1	6.88	0	0	0%	0	0	0	0	31.3	0	0	0
Arsenic	1	26.7	0	1	100%	26.7	26.7	26.7	0	22	1	0	0
Cadmium	1	5.7	0	1	100%	5.7	5.7	5.7	0	9.8	0	0	0
Copper	1	38.4	0	1	100%	38.4	38.4	38.4	0	100	0	0	0
Iron	1	45800	0	1	100%	45800	45800	45800	0	65000	0	0	0
Lead	1	241	0	1	100%	241	241	241	0	171	1	0	0
Manganese	1	492	0	1	100%	492	492	492	0	3597	0	0	0
Mercury	1	0.055	0	0	0%	0	0	0	0	23.5	0	0	0
Silver	1	0.46	0	0	0%	0	0	0	0	391	0	0	0
Zinc	1	1780	0	1	100%	1780	1780	1780	0	280	1	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	Avg. Value (mg/kg)	Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	>10x SL	>100x SL
South Fork													
Arsenic	3	537	0.169	3	100%	470	640	537	0.169	22	3	3	0
Cadmium	3	17.7	0.643	3	100%	6.2	29	17.7	0.643	9.8	2	0	0
Copper	3	290	0.182	3	100%	250	350	290	0.182	100	3	0	0
Iron	3	85700	0.265	3	100%	65000	110000	85700	0.265	65000	2	0	0
Lead	3	4800	0.811	3	100%	910	8700	4800	0.811	171	3	2	0
Manganese	3	718	1.55	3	100%	35	2000	718	1.55	3597	0	0	0
Zinc	3	3020	1.06	3	100%	950	6700	3020	1.06	280	3	1	0
Upper South Fork													
Arsenic	1	92	0	1	100%	92	92	92	0	22	1	0	0
Cadmium	1	5.2	0	1	100%	5.2	5.2	5.2	0	9.8	0	0	0
Copper	1	70	0	1	100%	70	70	70	0	100	0	0	0
Iron	1	77000	0	1	100%	77000	77000	77000	0	65000	1	0	0
Lead	1	21000	0	1	100%	21000	21000	21000	0	171	1	1	1
Manganese	1	4200	0	1	100%	4200	4200	4200	0	3597	1	0	0
Zinc	1	60	0	1	100%	60	60	60	0	280	0	0	0

Metals Concentrations - Statistical Summary By Source Type and Watershed
Upland Waste Rock

Analyte	ALL SAMPLES No. Samples Analyzed	ALL SAMPLES Avg. Value (mg/kg)	ALL SAMPLES Coefficient of Variation	DETECTS ONLY No. Detects Analyzed	% of Samples	Min. Value (mg/kg)	Max. Value (mg/kg)	Avg. Value (mg/kg)	Coefficient of Variation	Screening Value (mg/kg)	Exceedances >1x SL	Exceedances >10x SL	Exceedances >100x SL
Basin-Wide Summary													
Antimony	32	40	2.43	23	72%	1.3	466	53.6	2.1	31.3	6	1	0
Arsenic	42	231	2.74	38	90%	1.1	3610	253	2.62	22	26	6	1
Cadmium	100	19.3	2.29	96	96%	0.0255	298	20.1	2.23	9.8	36	5	0
Copper	67	287	2	67	100%	5.65	4190	287	2	100	35	5	0
Iron	103	49000	0.889	103	100%	2270	225000	49000	0.889	65000	25	0	0
Lead	98	7410	1.62	98	100%	1.78	63700	7410	1.62	171	81	53	15
Manganese	42	1450	0.764	42	100%	35	4200	1450	0.764	3597	1	0	0
Mercury	33	2.68	1.74	26	79%	0.09	21	3.39	1.48	23.5	0	0	0
Silver	33	24.1	1.85	24	73%	0.59	157	32.9	1.5	391	0	0	0
Zinc	99	5810	3.65	99	100%	1.4	166000	5810	3.65	280	64	24	3